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Waste Water Pilot Plant Research, Development, and Demonstration Permit Application

Date Published
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EXECUTIVE SUMMARY

This permit application has been prepared to obtain a research, development, and demonstration permit to perform pilot-scale treatability testing on the 242-A Evaporator process condensate waste water effluent stream. This permit application provides the management framework, and controls all the testing conducted in the waste water pilot plant using dangerous waste. This permit application provides a waste acceptance envelope (upper limits for selected constituents) and details the safety and environmental protection requirements for waste water pilot plant testing. This permit application describes the overall approach to testing and the various components or requirements that are common to all tests. This permit application has been prepared at a sufficient level of detail to establish permit conditions for all waste water pilot plant tests to be conducted.

Two documents will be used to detail each test conducted in the waste water pilot plant and to report the data obtained from these tests. These two documents are test procedures and test reports. Copies of the test procedures and test reports will be submitted quarterly to the U.S. Environmental Protection Agency and the Washington State Department of Ecology for review. Additionally, a quality assurance project plan is included that ensures that testing activities are conducted in a manner that will provide accurate and complete data.

The waste to be tested in the waste water pilot plant is the 242-A Evaporator process condensate. This process condensate is considered a dangerous waste because the condensate was derived from a mixed waste (containing both radioactive and dangerous components) that is listed for F001, F002, F003, F004, and F005. The 242-A Evaporator process condensate typically contains trace levels of radionuclides and stable chemicals. Both organic and inorganic constituents can be present as suspended solids or as dissolved solids. The level of contamination in the 242-A Evaporator process condensate is very low.

Regardless of the level of contamination, pilot-scale treatability testing of a waste water stream that is designated as a dangerous waste requires approval from the Washington State Department of Ecology and/or the U.S. Environmental Protection Agency. The research, development, and demonstration permit will satisfy this permitting requirement. While testing of synthetic and radioactive waste does not require a research, development, and demonstration permit, synthetic and radioactive waste is described in this permit application for informational purposes only to provide a complete discussion of the Hanford Facility waste water pilot plant testing program.

The 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility currently is being designed to treat the 242-A Evaporator process condensate and PUREX Plant nondangerous waste streams. Before the treatment system is constructed, the design of the system will need to be tested. This testing will demonstrate the technical feasibility and performance capability of innovative technologies or innovative treatment system configurations so that these technologies can be tailored to the needs of the Hanford Facility. This testing also will provide data to support the preparation of the required environmental permits and approvals.

Waste water pilot plant testing within the scope of this permit application will be conducted in the 1706-KE Building. Limited filtration testing using a dangerous waste will be conducted at the Liquid Effluent Retention Facility in support of the design of the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility. Until the treatment facility is built, the 242-A Evaporator process condensate will be stored in basins at the Liquid Effluent Retention Facility. The U.S. Department of Transportation-approved tanker trucks will be used to transport waste water to and from the 1706-KE Building. After testing the waste will be returned to the LERF basins.

The classes of treatment technologies that will be tested in the waste water pilot plant include the following: pH adjustment, organic removal (granular activated carbon adsorption and ultraviolet light mediated oxidation), inorganic removal (ion exchange and reverse osmosis), and suspended solids removal (filtration). A description of each of the specific treatment technologies is presented. In addition, the critical parameters for each technology are discussed along with the associated safety or controlling features. These discussions show that a wide margin of safety has been factored into the design of the waste water pilot plant and the tests to ensure operational safety of personnel and to ensure that no unacceptable releases to the environment will occur. If additional technologies are to be tested, this permit application will be modified to include these technologies.

A proposed operating envelope for the waste water pilot plant is contained in the permit application. This operating envelope is the upper limit for selected constituents to be safely tested in the waste water pilot plant. The operational envelope is based on the following considerations: tanker design limits, capacity of the waste water pilot plant ventilation system, and the waste water pilot plant materials of construction and system thermodynamics. A waste analysis plan is presented that will be used to confirm that waste waters are within the operating envelope.

This research, development, and demonstration permit also includes the contingency plans for the 1706-KE Building (location of most waste water pilot plant testing) and the Liquid Effluent Retention Facility, training and reporting requirements, and requirements for closure of the waste water pilot plant. The goal of closure for the waste water pilot plant is clean closure.

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APPENDICES (cont)

1.0 INTRODUCTION

Waste waters have been generated as result of operations conducted at the Hanford Facility for over 40 years. These waste waters were previously discharged to cribs, ponds, or ditches. Examples of such waste waters include steam condensates and cooling waters that have not been in contact with dangerous or mixed waste and process condensates that might have been in contact with dangerous or mixed waste (containing both radioactive and dangerous components).

Many measures have been taken to reduce the amount of contamination being discharged in these effluents. However, some of these waste waters still require additional treatment before release to the environment. Systems are being designed and built to treat these waste waters along with any future waste waters resulting from remediation activities on the Hanford Facility.

The waste waters typically contain trace levels of radionuclides and stable chemicals. Both organic and inorganic constituents can be present as either suspended solids or dissolved solids. While there is a wide variety of contamination in the waste waters, the level of contamination is very low.

One of the first treatment systems to be constructed will be the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility. This treatment unit will treat the process condensate from the 242-A Evaporator and PUREX Plant nondangerous waste streams. Until the PUREX Plant is restarted, the 242-A Evaporator process condensate is the only waste that will be treated in the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility. The 242-A Evaporator concentrates various liquid waste generated on the Hanford Facility. The liquid waste is stored in underground double-shell tanks (DSTs). The liquid waste in the DSTs is piped to the 242-A Evaporator, concentrated through evaporation, and returned to the DSTs for storage until final disposal. The condensate derived from this evaporation process, called '242-A Evaporator process condensate', is the waste water that will be tested. The 242-A Evaporator process condensate will be stored at the Liquid Effluent Retention Facility (LERF) until a treatment unit is operational. This waste water is a dangerous waste as defined by Washington Administrative Code (WAC) Chapter 173-303. The waste is designated dangerous due to the presence of spent solvents (F001, F002, F003, F004, and F005) and the toxicity (WT02).

Before the 242-A Evaporator process condensate treatment system is constructed, the design of the system will need to be tested to verify that the treatment methods selected are effective. Usually this testing will be performed on a small scale and is termed 'pilot testing'. A portion of the 1706-KE Building (an existing structure in the 100 KE Area) has been selected as the site for most of the testing. Limited testing (filtration) also will be performed at the LERF. Testing usually will be performed in two phases; the first phase will use synthetic waste and the second phase will use actual waste that might be a dangerous or a mixed waste. Because pilot-scale testing will be performed on a dangerous or on a dangerous or dangerous component of a mixed waste, a permit is required under the *Resource Conservation and Recovery Act* (RCRA) *of 1976* and the Washington State Department of Ecology *Dangerous Waste Regulations* (WAC 173-303). The research, development, and demonstration permit will satisfy this permitting requirement. This permit application applies only to the testing of the 242-A Evaporator process condensate and does not apply to waste water pilot plant testing of synthetic waste or PUREX Plant nondangerous waste streams that will be treated at the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility.

1.1 PURPOSE

This permit application is being written to obtain a research, development, and demonstration (RD&D) permit to perform pilot-scale treatability testing on the 242-A Evaporator process condensate. The treatability testing must be completed before construction of full-scale treatment systems. This testing is needed to:

- Demonstrate the technical adequacy, economic feasibility, and performance capability of new and innovative treatment technologies
- Tailor existing treatment technologies to site-specific design needs and operating conditions
- Improve the efficiency of treatment processes and refine performance capabilities
- Demonstrate that treatment systems produce a treated waste water that is nonhazardous
- Provide data to support the preparation of the required environmental permits, delisting petitions, or other regulator approvals
- Provide the U.S. Department of Energy Richland Field Office (DOE-RL) with a level of confidence that the treatment system will operate within the limits established by the environmental permits
- Provide data for full-scale plant design.

1.2 REGULATORY BASIS

Subtitle C of the RCRA requires the U.S. Environmental Protection Agency (EPA) to develop regulations for issuing permits for the treatment, storage, and disposal of any hazardous waste that is identified or listed under 40 CFR 261 subpart C or D. The *Hazardous and Solid Waste Amendments* (HSWA) *of 1984* amended Section 3005 of RCRA, to give the EPA authority under Section 3005(g) to issue RD&D permits for innovative and experimental hazardous waste treatment technologies or processes.

Prevailing wind speeds and directions across the Hanford Site are presented in Figure 1-2.

The Hanford Facility is defined as a single RCRA facility, identified by the EPA/State Identification Number WA7890008967, that consists of over 60 TSD units conducting dangerous waste management activities. The Hanford Facility consists of the contiguous portion of the Hanford Site that contains these TSD units and, for the purposes of the RCRA, is owned and operated by the U.S. Department of Energy (excluding lands north and east of the Columbia River, river islands, state owned or leased lands, lands owned or used by the Bonneville Power Administration, lands leased to the Washington Public Power Supply System, and the Ashe Substation). The Hanford Facility is a single site for purposes and provisions regulating 'offsite' or 'onsite' waste handling. The Hanford Facility portion of the Hanford Site is shaded on Figure 1-1.

Topographic maps, showing a distance of at least 1,000 feet (305 meters) around the 1706-KE Building and the LERF are provided in Appendix 1A. These maps are drawn at a scale of 1 centimeter equals 20 meters (1:2000). The contour interval (0.5 meter or 1.6 feet) clearly shows the pattern of surface water flow in the vicinity of 1706-KE Building and the LERF. The maps contain the following information:

- Map scale
- Date
- Prevailing wind speed and direction
- A north arrow
- Surrounding land use
- Location of the 1706-KE Building and LERF
- Access road location
- Access control.

1.5 GENERAL WASTE WATER PILOT PLANT DESCRIPTION

Waste water pilot plant testing within the scope of this permit application will be conducted at the following two locations on the Hanford Facility.

- Testing of mixed and dangerous waste will be conducted in the 1706-KE Building. The 1706-KE Building is located in the 100 KE Area (Figure 1-1). Waste will be transported to and from the 1706-KE Building by two 5,000 gallon (18,927 liter) tanker trucks.

- Limited filtration testing of mixed waste will be conducted at the LERF. The LERF consists of three 6.5-million gallon (24.6-million liter) surface impoundments (basins) located on a 39-acre site east of the 200 East Area. The LERF receives process condensate from the 242-A Evaporator.

The locations of the 1706-KE Building and LERF are shown in Figure 1-3 and Figure 1-4, respectively. The exact locations of the 1706-KE Building and the LERF are:

	Latitude	Longitude
1706-KE Building	N46°38'57.2"	119°35'34.2"
LERF	N46°33'42.3"	119°30'21.7"

More detailed descriptions of the 1706-KE Building and the LERF testing locations are presented in Section 4.0.

1.6 REPORTING AND RECORDKEEPING

This section summarizes the waste water pilot plant reporting and recordkeeping requirements. The reports will be submitted to Ecology and/or the EPA as required by applicable regulations, and required records will be maintained at the waste water pilot plant or by other Hanford Facility organizations as appropriate.

1.6.1 Notification of Dangerous Waste Activities

Regulations require that facilities involved in the generation or transportation of dangerous waste, or the owner or operator of a treatment, storage, and/or disposal facility, have a current EPA/state identification number. The Hanford Facility is a single RCRA facility operating under EPA/State Identification Number WA7890008967. The waste water pilot plant will operate under this same EPA/state identification number.

1.6.2 Recordkeeping

Generator records maintained by the Hanford Facility include the following:

- Records of waste generated onsite
- Records of waste packaged to be shipped offsite
- Land disposal restriction records.

Waste generation records will be retained as required by 40 CFR 262.40 and WAC 173-303-210.

Test procedures, test data, test logbooks, and other test-related information will be stored as required by Hanford Facility procedures and individual test procedures.

1.6.3 Reporting

Onsite transfers of liquid mixed waste to and from the waste water pilot plant, nonradioactive dangerous waste from the waste water pilot plant to the

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APPENDIX

FIGURES

TABLE

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The QAPP is intended to be generic in nature and will be applicable to testing of synthetic waste and actual dangerous waste. The QAPP will provide the overall requirements under which waste water pilot plant testing will be executed. The QAPP also will establish the requirements for the sampling and analytical services that will be provided by both onsite and offsite laboratories.

It is the intent of the QAPP to allow a graded approach to the application of QA. For example, the portion of the testing activity that will be conducted for process optimization does not require the high level of QA afforded to those tests that will provide data to support permitting or delisting activities. The identification of the appropriate QA level for the data and analytical information related to sampling will be included within the associated test procedure.

Analytical data for process optimization studies will be obtained from a Hanford Site laboratory using procedures based on EPA methods or other recognized and accepted industrial waste water procedures (e.g., American Society for Testing and Materials and American Water Works Association). Analytical data that are to be used in permit applications might be required to be performed offsite by a certified laboratory program (CLP) laboratory.

2.3 SCHEDULE

The waste water pilot plant will be used first to support the 242-A Evaporator/PUREX Condensate Treatment Facility. Waste water pilot plant testing with synthetic waste will be performed at the 1706-KE Building after the Hanford environmental compliance (HEC) environmental assessment (EA) finding of no significant impact (FONSI) is approved and the necessary modifications are performed to the 1706-KE Building. The FONSI was approved on March 11, 1992. The 1706-KE Building modifications will include: removing or replacing loose floor tiles, sealing the floor, plugging floor drains, sealing the walls, upgrading the ventilation system, refurbishing the change rooms, installing tanker loading and unloading areas, intermediate storage tanks, process equipment, and associated piping and instrumentation. Synthetic waste testing will be performed at other sites before synthetic testing takes place at the 1706-KE Building.

The 242-A Evaporator has not been operational since 1989 and currently is undergoing upgrade modifications. When the 242-A Evaporator becomes operational, the 242-A Evaporator process condensate will be stored in the LERF. A minimum 2-month period will be required for the waste material to accumulate before using the material in waste water pilot plant testing. This 2-month period is necessary because of operational considerations and because of the need to obtain a representative sample of process condensate. The 242-A Evaporator waste will be available for waste water pilot plant testing within the time frame of November to December 1992.

Two tentative schedules are included (Figure 2-1 and 2-2). Figure 2-1 shows the overall schedule for waste.water pilot plant testing. Figure 2-2 provides a detailed schedule for waste water pilot plant testing, as now developed. As additional information on the detailed testing becomes available, the additional information will be provided in the waste water pilot plant quarterly reports.

Before any testing with actual waste from the 242-A Evaporator, the RD&D permit must be in place and an operational readiness review in accordance with DOE Orders must be satisfactorily completed on the waste water pilot plant. The operational readiness review is an internal review to ensure that the waste water pilot plant is ready to start operations. The operational readiness review will be kept in the project files and will be available for the EPA and Ecology inspection on completion of the review.

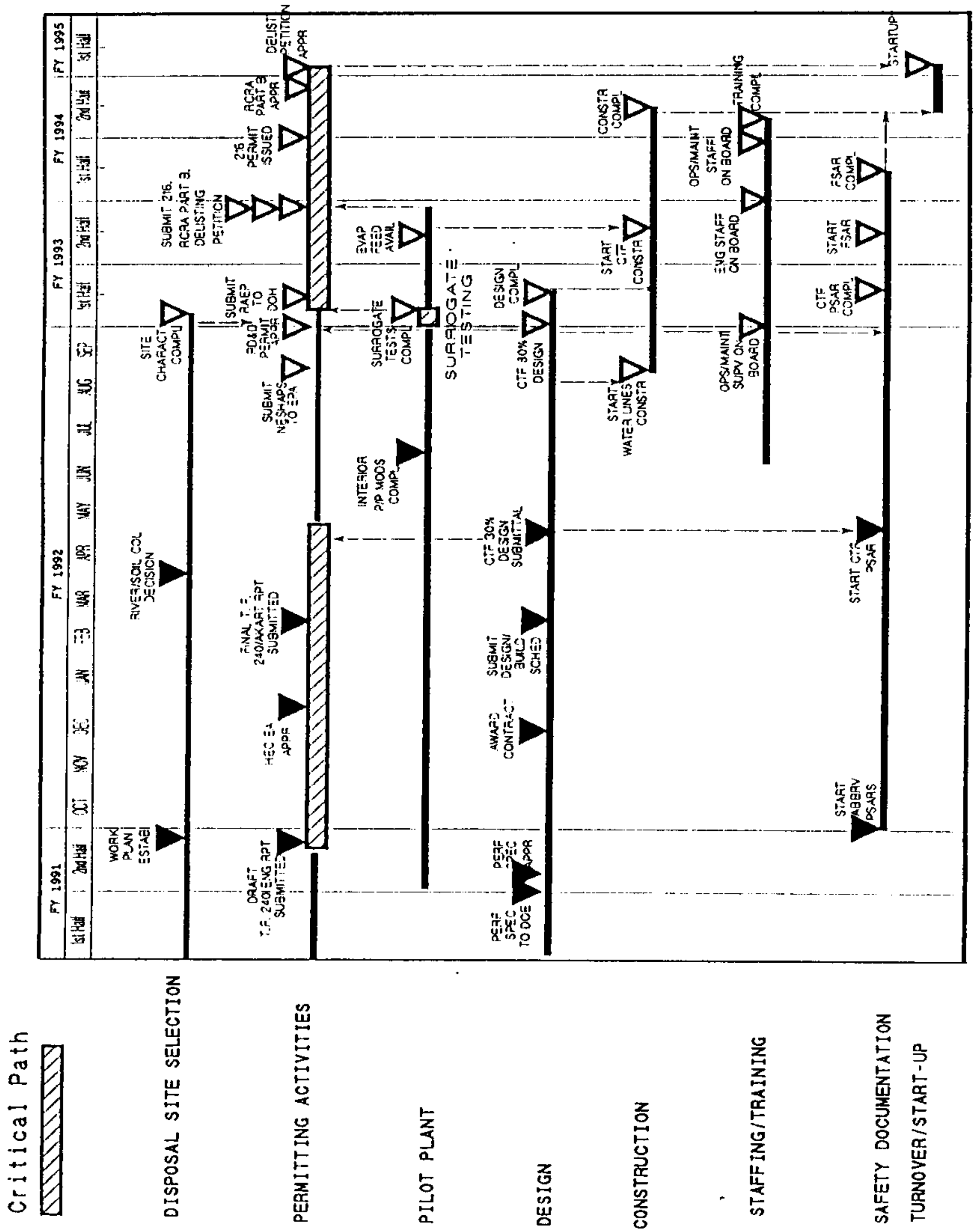
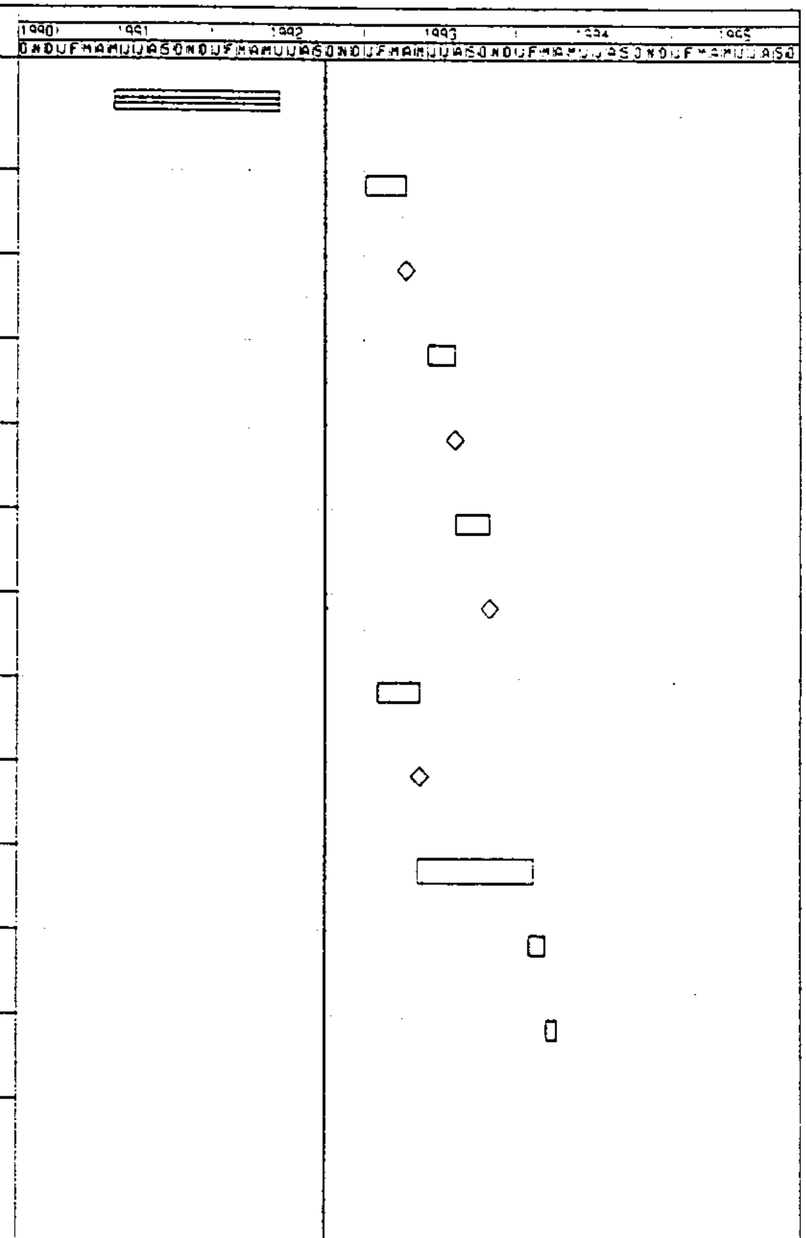


Figure 2-1. 242-A Evaporator/PUREX Condensate Treatment Facility Summary Schedule.

9 1 1 2 9 2 1 2 5 1

ACTIVITY ID	ACTIVITY DESCRIPTION	EARLY START	EARLY FINISH	ORIG DUR
2CC9W917	PREPARE FILTRATION TEST PLAN	15MAY91A	12JUN92A	272
2CC9W919	REWRITE FILTRATION TEST PLAN	4JAN93	9APR93	69
2CC9W921	ISSUE FILTRATION TEST PLAN		9APR93	0
2CC9W923	CONDUCT INITIAL FILTRATION TESTING AT LERF	1JUN93	5AUG93	46
2CC9W925	COMPLETE INITIAL FILTRATION TEST AT LERF		5AUG93	0
2CC9W927	PREPARE FILTRATION TEST REPORT	6AUG93	27OCT93	58
2CC9W929	COMPLETE LERF FILTRATION TEST REPORT		27OCT93	0
2CC9WA01	PREPARE TEST PLAN FOR TESTS USING LERF FEED	1FEB93	11MAY93	71
2CC9WA03	COMPLETE TEST PLAN FOR TESTS USING LERF FEED		11MAY93	0
2CC9WA05	CONDUCT TESTS USING LERF FEED	2FEB93	28JAN94	125
2CC9WA11	DRAFT LERF FEED TEST REPORT	31JAN94	11MAR94	29
2CC9WA13	FINAL LERF FEED TEST REPORT	14MAR94	8APR94	20



Plot Date 28OCT92
Data Date 30SEP92
Project Start 1OCT90
Project Finish 1NOV95

(c) Primavera Systems, Inc

EFFLUENT TREATMENT PROGRAMS
242A EVAP/PUREX PLNT COND TRMT FAC
PROJECT C-018H HOT TESTING SCHEDULE

Date	Revision	Checked	Approved

Figure 2-2. Tentative Waste Water Pilot Plant Testing Summary.

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APPENDICES

TABLES

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3.0 WASTE CHARACTERISTICS

This section presents a general description of the types of waste water that will be treated in the waste water pilot plant. A description of the chemical spikes that will be added to the waste during testing also is presented. An operating envelope has been defined to limit the type of waste that will be accepted in the waste water pilot plant. This section also includes a description of the waste analysis plan that will be used to ensure that the composition of the waste to be tested is within the parameters specified in the waste acceptance limits of the waste water pilot plant.

3.1 WASTE WATER PILOT PLANT WASTE STREAM TO BE TESTED

The following sections describe the waste water stream to be tested at the waste water pilot plant, and discuss the waste composition and dangerous waste designation of the 242-A Evaporator process condensate.

3.1.1 Description of Waste Water

The 242-A Evaporator process condensate stream will be the only waste water tested in the waste water pilot plant; no offsite waste will be received.

The 242-A Evaporator concentrates liquid waste stored in the underground double-shell tanks (DSTs). Liquid waste in the DSTs is piped to the 242-A Evaporator, concentrated through evaporation, and returned to the DSTs for storage until final disposal. The condensate derived from this evaporation process, called '242-A Evaporator process condensate', is the waste water that will be tested at the waste water pilot plant. The 242-A Evaporator process condensate will be stored at the LERF until the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility is operational.

3.1.2 Waste Stream Composition

A variety of constituents are contained in the 242-A Evaporator process condensate. Constituents can be classified as suspended solids, organics, and dissolved solids. Suspended solids include colloids, grit, and organic debris (e.g., algae). Organics include compounds such as acetone, butanol, methyl isobutyl ketone, methylene chloride, and tributyl phosphate. Dissolved solids include inorganics and radionuclides. The exact composition of the 242-A Evaporator process condensate is somewhat variable, depending on the source of DST waste that is treated at the 242-A Evaporator. In general, the amount of organic contaminants in the 242-A Evaporator process condensate is less than 100 parts per million (i.e., less than 0.01 percent).

Analytical results of 34 samples [collected and analyzed in accordance with SW-846 protocols (EPA 1986b)] and other process control samples from the

242-A Evaporator process condensate are summarized in Table 3-1. The samples were collected between August 1985 and March 1989. It has not been possible to collect a 242-A Evaporator process condensate sample since April 1990, when the 242-A Evaporator was taken out of service. Table 3-1 shows the range of constituents that might be encountered in the waste stream. It should be emphasized that no one waste water sample contains all of the constituents listed in the table nor does any one waste water sample contain the maximum concentration of all of these constituents on a regular basis.

3.1.3 Waste Stream Designation

In accordance with requirements in WAC 173-303, the 242-A Evaporator process condensate is designated as (1) dangerous because the condensate is derived from a listed waste and (2) 'state-only' toxic dangerous waste because the equivalent concentration percent sum of all applicable constituents is greater than 0.001 percent. The waste designations for the 242-A Evaporator process condensate are contained in the LERF dangerous waste permit application (DOE/RL 1991c) and the 242-A Evaporator dangerous waste permit application (DOE/RL 1991a). Information on these waste designations is provided in the following paragraphs.

The waste is designated dangerous because the process condensate is derived from the DST waste - a 'listed waste'. The DST waste has been designated dangerous (listed waste) due to the presence of spent solvents, namely 1,1,1 trichloroethane (F001), methylene chloride (F002), acetone and methyl isobutyl ketone (F003), cresylic acid (F004), and methyl ethyl ketone (F005).

The 1,1,1 trichloroethane was not detected in the 34 samples of the 242-A Evaporator process condensate above a concentration of 0.005 parts per million (detection limit). The 1,1,1 trichloroethane was used as a solvent in decontamination activities at B Plant and has been discarded to the DSTs.

Methylene chloride was not detected in the 34 samples of the 242-A Evaporator process condensate. Methylene chloride was used as a solvent in decontamination activities at T Plant and has been discarded to the DSTs.

Acetone was detected in all 34 242-A Evaporator process condensate samples with an average concentration of 0.980 parts per million. The acetone was used in laboratories to dry glassware and could have been discarded through drains to the DSTs.

Methyl isobutyl ketone (hexone) was detected in 10 of the 34 samples at an average concentration of 0.011 parts per million. Methyl isobutyl ketone was used in the solvent extraction process [reduction-oxidation (REDOX) process] and was discarded to single-shell tanks as a spent solvent and eventually transferred to the DSTs.

Cresylic acid was not detected in the 34 samples of the 242-A Evaporator process condensate. Cresylic acid was used as a solvent in decontamination activities at T Plant and has been discarded to the DSTs.

Methyl ethyl ketone (2-butanone) was detected in 25 of the 34 samples at an average concentration of 0.051 parts per million. Methyl ethyl ketone was used in past chemical processing operations and has been determined to be a spent solvent.

The 1,1,1 trichloroethane methylene chloride, acetone, methyl isobutyl ketone, cresylic acid, and methyl ethyl ketone in the 242-A Evaporator process condensate are not known to be 'discarded chemical products' as defined by WAC 173-303-081.

Two other 'listed' constituents were present in the 242-A Evaporator samples. In 30 of the 34 samples, 1-butanol (butyl alcohol) was detected at an average concentration of 9.8 parts per million. The 1-butanol is an impurity and degradation product from tributyl phosphate used at the PUREX Plant. Pyridine was detected in 1 of the 34 samples at a concentration of 0.55 parts per million. Pyridine was not used in chemical processing on the Hanford Site. Neither 1-butanol nor pyridine are known to be discarded chemical products or spent solvents as defined in WAC 173-303-081 and-082.

The 242-A Evaporator process condensate also is designated a toxic dangerous waste (WT02) by the procedure set forth in WAC 173-303-084(5) and -101. Because the equivalent concentration method of determining toxicity is not included in 40 CFR 261, the waste is considered to be a 'state only' dangerous waste.

The 242-A Evaporator process condensate is not a persistent dangerous waste because the concentrations of halogenated hydrocarbons and polycyclic aromatic hydrocarbons were below 0.01 and 1.0 percent, respectively (WAC 173-303-102).

Three constituents potentially present in the 242-A Evaporator process condensate were determined to be carcinogenic substances [cadmium chloride, nickel (II) hydroxide, and n-nitrosodimethylamine]. Because none of the compounds exceeded 0.01 percent and the sum was less than 1.0 percent of the waste quantity, the waste is not a carcinogenic dangerous waste per WAC 173-303-084(7) and -103(2).

The waste is not ignitable as defined by WAC 173-303-090(5) because, as a dilute aqueous waste, the concentration of oxidizer (e.g., nitrate) and the sum of concentrations of potentially ignitable contributors are too low to be an ignitable waste. Flash point testing was not performed on the process condensate. The nitrate in the waste is dilute (averaging 2.8 parts per million) and it is not expected to support the combustion of organic matter. Nitric acid is given an oxidizer hazard class when the concentration exceeds 40 weight percent (400,000 parts per million). The ignitability index was calculated for pure substances having a flash point of less than 140 °F (60 °C). The ignitability index calculated from these constituents is between 0.0002 and 0.008 percent. Samples with an ignitablity index of less than 1 percent were not considered ignitable (DOE-RL 1991a).

To be designated a corrosive dangerous waste per WAC 173-303-090(6), the waste must have a pH less than or equal to 2 or greater than or equal to 12.5.

Measured pH for the 242-A Evaporator process condensate ranged from 7.8 to 11.3 standard units, therefore the process condensate is not considered to be a corrosive waste.

A reactive dangerous waste, as defined in WAC 173-303-090(7), undergoes violent change without detonating, reacts violently or generates toxic gases when mixed with water, a cyanide- or sulfide-bearing waste, or is capable of explosive reaction if subjected to a strong initiating source. The process condensate is a dilute aqueous waste and clearly does not meet the criteria contained in WAC 173-303-090(7) for reactive waste.

The total analyte concentrations for the 34 samples of 242-A Evaporator process condensate did not exceed the toxicity characteristics leaching procedure (TCLP) limits set in WAC 173-303-090(8)(c). Only four analytes from the TCLP list were detected in the waste (barium, cadmium, chloroform, chromium, mercury, methyl ethyl ketone, and pyridine). None of the constituents exceeded the TCLP limits. Therefore, the 242-A Evaporator process condensate is not a toxicity characteristic dangerous waste.

3.2 CHEMICAL SPIKES

The waste water pilot plant will conduct tests using both synthetic and actual mixed waste. Synthetic waste will be prepared and tested at elevated concentration levels of selected chemical constituents during the synthetic testing program. Limited testing will be performed on actual mixed waste (242-A Evaporator process condensate) to confirm the results observed during synthetic testing.

To test all the potential contaminants of regulatory concern in the waste water feed is impractical. Instead, the approach to be used is to systematically select a number of analyzable chemicals that accurately represent all of the contaminants of legitimate regulatory concern and include these constituents on a 'chemical spike list'. Chemical spikes are the chemical constituents added to the actual waste above the maximum concentrations expected in the 242-A Evaporator process condensate. Chemical spikes will be used to determine efficiencies of the test equipment at constituent concentrations ranging up to several orders of magnitude greater than expected in the actual waste.

The first step in developing a spike list was to develop a comprehensive list of 452 chemical constituents of regulatory concern as described in Section 3.2.1. The second step was to develop a screened regulatory list through the application of selection criteria to the comprehensive list of regulatory concern. The rationale for eliminating chemicals to develop the screened regulatory list is presented in Section 3.2.2.

The constituents in the screened regulatory list were reduced further by grouping the constituents into classes of chemicals. This grouping is based on *A Project Manager's Guide to Requesting and Evaluating Chemical Analyses* (EPA 1991). The selected chemical is judged to be representative of its class. Representativeness is evaluated in terms of evaporator carry over potential (e.g., volatility and solubility) and process efficiency [e.g., susceptibility to ultraviolet oxidation (uv/ox) breakdown]. The makeup of the final chemical spike list is largely controlled by the needs of the individual tests. The definition of the individual tests are not considered to be within the scope of this permit application.

One additional criteria was applied to the spike list. The chemical could not be a Class A or B1 carcinogen, chlorinated dioxin or furan, herbicide, pesticide or polychlorinated biphenyl (PCB). This ensures that unconfirmed compounds that have a potential for significant health effects are not introduced into the waste water pilot plant.

The basis for the spike concentrations is the larger value of 10 times the minimum practical detection limit or 10 times the maximum concentration in Table 3-1 (except ammonia, 1-butanol, tributyl phosphate, and carbonate for which the maximum concentration value was used). These levels were chosen to ensure that process removal efficiencies up to 90 percent could be detected. At the same time, concentrations are low enough that the spiked feed will not pose a serious hazard to waste water pilot plant personnel.

The spike list shown in Table 3-2 is believed to accurately represent the contaminants potentially present in the waste water feed. Any waste water treatment plant that can successfully treat feed with this wide range of chemicals will have demonstrated a high degree of capability and robustness.

3.2.1 Chemical Constituents of Regulatory Concern

The chemical compounds of regulatory concern consist of four groups: (1) the F001, F002, F003, F004, and F005 chemicals; (2) the 40 CFR 261, Appendix VIII compounds (Appendix VIII constituents); (3) the Priority Pollutants as specified under 40 CFR 136, identified in the *Clean Water Act*; and (4) chemicals with health-based levels (EPA 1989).

The first group of chemicals included on the regulatory list are the five constituents that originally led to the designation of the 242-A Evaporator process condensate as listed: The 1,1,1 trichloroethane, methylene chloride, acetone, methyl ethyl ketone (2-butanone), cresylic acid, and methyl isobutyl ketone (hexone).

The second group of chemicals includes the full list of Appendix VIII constituents. These chemicals represent all of the specific chemicals that EPA regulates under the RCRA program.

The third group incorporates additional chemicals from the Priority Pollutant list that are not already duplicated in the first two groups of chemicals.

The fourth group incorporates additional chemicals used in the evaluation of delisting petitions that have health-based levels (EPA 1989).

3.2.2 Screened Regulatory List

The comprehensive regulatory list contains many chemicals for which there is no reason to anticipate their presence in the waste water stream. A screened list of chemicals was derived by deleting certain chemicals from the comprehensive regulatory list for the following reasons.

Some chemicals on the Appendix VIII list (40 CFR 261) were eliminated because of their limited or specific use or occurrence. The chemicals fall into very narrow categories that include experimental drugs, previously used therapeutic agents, anticancer agents, chemical warfare agents, natural products, microbial products, and other similar chemicals. There is no reason to believe that these chemicals would be present in the waste stream planned for testing in the waste water pilot plant.

Several organic chemicals and inorganic elements on Appendix VIII (40 CFR 261) with the designation "not otherwise specified" (N.O.S.) were eliminated. This designation is used to describe generic classes of inorganic compounds (e.g., lead compounds N.O.S.) or organic compounds (e.g., chlorinated benzenes, N.O.S.). Organic chemicals designated as N.O.S. can be legitimately eliminated from the comprehensive list because the specific isomers of concern within the group (such as o- or m-dichlorobenzene) already are individually listed on the comprehensive list. Inorganic chemicals designated N.O.S. can be eliminated because the parent metal (such as lead) or the individual compound (such as lead acetate) also is included on the list.

Some inorganic salts on the Appendix VIII list (40 CFR 261) were deleted because the metallic cations are already on the comprehensive list of chemicals of concern. These chemicals are included in the analysis for the parent metal and deletion will not result in the loss of significant information.

Some nonpriority pollutant pesticides and herbicides were removed from the comprehensive list. The basis for this is that no pesticides or herbicides have been identified in either the Hanford Site inventory document (WHC 1990) or in any of the historical data for waste water streams.

3.3 OPERATING ENVELOPE

The purpose of the operating envelope is to preclude waste water pilot plant conditions that would be potentially unsafe to human health and the environment. The operating envelope includes three components. The first component addresses the composition of the waste water received in the waste water pilot plant. The second component addresses the composition of the waste water after modification by chemical spikes. The third component addresses the operating parameters that are in place to ensure that the equipment in the waste water pilot plant will be operated within limits that protect human health and the environment.

3.3.1 Waste Water Acceptance Criteria

The composition of the waste feed to the waste water pilot plant has been characterized by analyses of 34 samples and other process control samples of 242-A Evaporator process condensate collected over a period of almost 4 years (Table 3-1). Some variability is expected in waste composition, thus a sampling program will be implemented to ensure that the waste composition will be within the operational capabilities of the waste water pilot plant.

The waste acceptance limits for the waste transferred to the waste water pilot plant is shown in Table 3-3. Waste that exceeds acceptance criteria limits will not be received at the waste water pilot plant. The metals include all the toxic metals reasonably anticipated in the 242-A Evaporator process condensate.

The limits were derived by raising the amounts of metals and volatile organics detected in the 242-A Evaporator process condensate by one or two orders of magnitude (10 or 100 times). The basis for the limits is to keep personnel exposure/environmental contamination risk to as low as reasonably achievable.

A further limitation is placed on the shipment of waste water via the tank trailers, i.e., the waste water must be Low Specific Activity (LSA) with respect to the radionuclide content to meet U.S. Department of Transportation requirements.

3.3.2 Waste Water Operating Envelope

The operating envelope is defined as the maximum concentration of chemical constituents in the waste water. The operating envelope maximum concentrations are presented in Table 3-4.

After introduction into the waste water pilot plant, the waste composition could be modified by the addition of chemical spikes. Therefore, the waste water operating envelope must take into account the addition of chemical spikes. The maximum concentration in the waste water operating envelope (Table 3-4) was derived by adding the maximum concentration in the waste acceptance limits (Table 3-3) plus the maximum concentration for that constituent in the chemical spike list (Table 3-2). For constituents in the 242-A Evaporator process condensate (Table 3-1) that are not included in the waste acceptance limits, the maximum concentration in the waste water operating envelope (Table 3-4) will be the concentration of the constituent in the process condensate (Table 3-1) plus the concentration in the spike list (Table 3-2).

3.3.3 Operating Parameters

Operating parameter limitations are required only for 'critical parameters'. A critical parameter is defined as an operating parameter for which loss of control of the parameter can affect safety of Hanford Site personnel or the general public or result in the contamination of the 1706-KE Building, LERF, or the general environment.

On this basis, the critical parameters for the waste water pilot plant include:

- High pressure
- High vacuum
- Ultraviolet light
- Corrosion
- Tank overflow
- Leakage
- Corrosivity
- High temperature
- Radiation
- Differential pressure
- Low vessel vent vacuum.

The critical parameters are discussed in detail in Section 4.0. The critical parameters, their limitations, and how the parameters are monitored and controlled are shown in Section 4.0, Table 4-4.

3.4 WASTE ANALYSIS PLAN

The waste analysis plan will provide data to establish that the 242-A Evaporator process condensate transported from the LERF is within the waste acceptance limits for pH, ammonia, toxic metals, and volatile organic compounds. This will be accomplished through sampling and analysis of the process condensate before unloading at the 1706-KE Building.

The waste analysis program is based on the following considerations.

- The toxicity of the waste is low.

- After pilot plant testing, the waste will be transferred to the LERF for storage until treatment at the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility.

- The potential release of volatile organics to the atmosphere will be controlled at the 1706-KE Building by the use of two stages of carbon adsorbers, in series. The use of an interstage organic vapor analyzer provides continuous on-line monitoring with alarm to indicate 'breakthrough' (saturation, or full loading) of the first stage adsorber.

The concentrations of the constituents added during spiking will be controlled through the use of test plans and test procedures and to not exceed the levels shown in Table 3-4.

3.4.1 Sampling and Preservation

To determine if the waste is within the waste acceptance limits, a composite sample of the LERF waste water will be collected during the filling of the tank trailer. This will be accomplished using a sample port on the tank trailer fill line.

Samples will be collected and preserved in accordance with Table 4.1 of the QAPP (Appendix 2A).

3.4.2 Analyses and Analytical Methods

The waste water samples collected during the filling of the tank trailer at the LERF will be analyzed for pH, ammonia, metals, and volatile organic compounds. The analytical methods to be used are listed in Table 3-3. The waste acceptance limits analyses will be performed at QA Level II in accordance with the QAPP (Appendix 2A). The data will be used to confirm that the waste acceptance limits (Table 3-3) of the operating envelope are not exceeded before unloading the waste water into the pilot plant.

A more detailed list of analytical methods to be used at the waste water pilot plant, including extraction methods, is shown in Table 3-5.

The waste water analysis will include determining concentrations of a number of radionuclide constituents, as well as total alpha, total beta, and total gamma radiation (Table 3-6). A description of the radionuclide analytical methods are given in Appendix 3B. Because the radionuclides are not subject to regulation under WAC 173-303, the radionuclide analytical methods are provided for information only. The radionuclide data will be used to confirm that the LSA limits have not been exceeded before shipment of the waste to the pilot plant.

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Table 3-1. 242-A Evaporator Effluent Characterization Data.
(sheet 2 of 3)

Parameter	Units[a]	Average	90% CI	Maximum
Caproic acid	ppm	0.070		
3,5-Dimethyl-pyridine	ppm	0.021	0.023	0.024
Dimethyl-nitrosamine	ppm	0.057		
Dodecane	ppm	0.043	0.052	0.046
Ethoxytriethylene-glycol	ppm	0.099	0.12	0.15
Ethyl alcohol	ppm	0.002		
Hexadecane	ppm	0.017		
Heptadecane	ppm	0.018		
Methoxydiglycol	ppm	0.04	0.052	0.052
Methoxytriglycol	ppm	0.022	0.37	0.37
Methylene chloride[b]	ppm	0.012	0.14	0.18
Methyl n-propyl ketone	ppm	0.0093	0.0097	0.012
Methyl n-butyl ketone	ppm	0.013	0.014	0.079
MIBK (Hexone)	ppm	0.011	0.014	0.068
2-Methylnonane	ppm	0.016	0.017	0.017
Pentadecane	ppm	0.020		
Phenol	ppm	0.033		
2-Propanol	ppm	0.022		
Pyridine	ppm	0.055		
Tetradecane	ppm	0.076	0.083	0.44
Tetrahydrofuran	ppm	0.037	0.039	0.17
Tributyl phosphate	ppm	3.9	4.1	21.0
1,1,1-Trichloroethane[b]	ppm	0.005		
Tridecane	ppm	0.07	0.077	0.35
Triglyme	ppm	0.09		
Alpha	pCi/L	160	35.0	750
Beta	pCi/L	4,600	6,000	74,000
Strontium-90[c]	pCi/L	5,200	7,600	81,000
Ruthenium-106	pCi/L	10,500	11,080	17,800
Cesium-137[c]	pCi/L	4,400	5,400	26,000
Promethium-147	pCi/L	1,300	1,600	4,100
Uranium (gross)	pCi/L	20	33	140
Tritium	pCi/L	5,600,000	6,300,000	24,000,000
Plutonium-239	pCi/L	0.00037	0.00068	0.0024

Table 3-1. 242-A Evaporator Effluent Characterization Data.
(sheet 3 of 3)

Parameter	Units[a]	Average	90% CI	Maximum
Tin-113	pCi/L	540	770	2,500
Europium-155	pCi/L	1,400	na	1,400

[a] Units: μS = microsiemen
SU = standard pH units
ppm = parts per million
pCi/L = picocuries per liter

[b] Detected only in sample blanks.

[c] Cesium-137 and strontium-90 values have been multiplied by 10 to account for the removal of the existing ion exchange system in the 242-A Evaporator.

Abbreviations: CI = confidence interval
na = not applicable

NOTE: Radionuclide data presented for information only.

CONTENTS

APPENDICES

APPENDICES (cont)

FIGURES

FIGURES (cont)

TABLES

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4.0 PROCESS INFORMATION

Waste water pilot plant testing of treatment technologies using mixed and dangerous waste will be conducted primarily in the 1706-KE Building. Limited testing also will be performed at the LERF. The following sections provide information on the waste water pilot plant and testing equipment, testing performed at the LERF, loading and unloading of waste at the testing locations, waste transfer, and equipment decontamination.

4.1 PILOT PLANT TESTING AT THE 1706-KE BUILDING

This section provides a general discussion of the 1706-KE Building, waste water pilot plant containment, ventilation system, and operating capacity. The section also provides a more detailed discussion of the types of technologies to be used, equipment descriptions, and critical parameters related to potential safety concerns.

4.1.1 The 1706-KE Building

The 1706-KE Building is located adjacent to the decommissioned 100-KE reactor, and originally was designed to study the effects of water quality and decontamination solvents on reactor hardware and fuel element materials. With the startup of the N reactor in 1965, and the shutdown of the KE reactor in 1971, the 1706-KE Building was used to perform operational testing in support of N reactor. The testing programs included water quality control, corrosion, decontamination, procedure development, waste treatment systems development, ion exchange evaluations, and material testing. Testing is still being performed in support of N reactor shutdown and the 100 KE Area storage basins.

The 1706-KE Building is part of a complex of three buildings, namely 1706-KE, 1706-KEL, and 1706-KER. Portions of the three buildings form what is known as the Engineering and Environmental Demonstration Laboratory. As shown on Figure 1-3, the 1706-KEL Building is attached to the west side of the 1706-KE Building and the 1706-KER Building is located north of the 1706-KE and 1706-KEL Buildings. The 1706-KER Building is joined to the 1706-KE and 1706-KEL Buildings beneath ground level.

Waste water pilot plant activities will take place in the 1706-KEL and 1706-KE Buildings. As shown in Figure 4-1, the waste water pilot plant, storage area, and men's change room will be located in the 1706-KEL Building. The waste water pilot plant analytical lab, storage area, women's change room, and offices will be located in the 1706-KE Building. Unless otherwise specified, this permit application will use the term '1706-KE Building' to refer to the portions of 1706-KE and 1706-KEL Buildings used for waste water pilot plant activities.

The 1706-KE Building was chosen for the waste water pilot plant operation because of the available space, trained personnel, available utility services, and existing ventilation system. Also, the 1706-KE Building will require minimal renovation, and is designated for radiological activities. The 1706-KE Building also contains adequate laboratory analytical space to perform the necessary analyses required for process information.

The 1706-KEL Building is concrete block and reinforced concrete construction and is designed for a Safety Class 2 seismic loading (DOE-RL 1988). The area designated for waste water pilot plant testing is approximately 36 by 34 feet (11 by 10.4 meters) [1,200 square feet (111.5 square meters)] with an additional 900 square feet (84 square meters) available for support equipment and storage (Figure 4-1). Equipment access to this pilot plant area is limited by a 82 inch (208 centimeter) high by 58 inch (147 centimeter) wide double swinging metal door. The floor is 4½-inch (11-centimeter) reinforced concrete with a load capacity of 100 pounds per square foot (488 kilograms per square meter). Available utilities are raw water, electrical supply, sanitary water, demineralized water, and distribution lines for bottled gas (e.g., nitrogen, etc.).

4.1.2 Waste Water Pilot Plant Spill Prevention and Containment

A primary safety concern at the waste water pilot plant will be spill prevention and containment. A multi-tiered approach has been taken, the highest priority being the prevention of leaks or spills. This is followed by secondary containment at the potential points of leakage, and finally by use of the building as the final form of tertiary containment.

To prevent the occurrence of leaks or spills, the following steps are planned:

- All process piping and equipment will be aboveground and easily accessible for daily visual inspections

- Process piping and equipment will be leak checked at or above operating pressure before use

- All receiving tanks will be equipped with liquid-level indicators and interlocked with the corresponding supply pump to prevent overfilling

- Process piping designs, tank designs, and equipment inspections will be performed in accordance with the WAC 173-303-640.

Secondary containment will be provided for equipment and piping where required by WAC 173-303-640. Welded piping will be used whenever possible for process piping at the waste water pilot plant. However, due to the flexibility required to operate a waste water pilot plant, threaded and flanged fittings also will be used to allow the necessary piping changes. Containment pans will be used at the threaded or flanged fittings. Because all equipment has not been purchased at this time and also because of the flexibility required to successfully complete the waste water pilot plant mission, specific containment pan designs for each situation are not possible at this time. The following criteria will be used for all secondary containment at the waste water pilot plant.

- Except when the equipment is totally enclosed (such as the LERF filtration equipment), the catch pan footprint will be at least 1 foot (0.3 meter) greater in each horizontal dimension than the footprint of the equipment.

- A minimum height of 3 inches (7.6 centimeters) will be used (height may be greater to increase volume of the containment).

- The volume of the containment for equipment will be adequate to hold a minimum of 110 percent of the retention volume of the largest vessel for that piece of equipment.

- Drip pans under pipe fittings will have a minimum capacity of 5 gallons (19 liters). Frequency of inspection and pipe operating pressure also will be considered in sizing of the pans.

- Material of construction will be either aluminum or stainless steel. Stainless steel will be used whenever the possibility of corrosion exists with the material being contained.

- Flanged fittings with an operating pressure greater than 50 pounds per square inch (345 kilopascals) gage will be fitted with spray guards. Spray guards will be required for the reverse osmosis and the filtration units as discussed in Sections 4.1.5.3.1.2 and 4.1.5.4.2.

- The WAC 173-303-640 will be used to determine containment requirements.

Examples of this criteria is shown in Table 4-1 for the two types of test equipment that currently are available.

The waste water pilot plant will have two aboveground double-shell 3,000-gallon (11,000-liter) interim storage tanks that will be capable of storing the waste water between tests on different treatment technologies or as feed material. These two storage tanks will be placed outside the 1706-KE Building (Figure 4-1) and will be plumbed to provide 6,000 gallons (22,700 liters) of storage. The inner shell of these tanks will be of stainless steel construction with outer shells of carbon steel. Both tanks will be vented to the 1706-KE Building ventilation system. Leak detection inspection will be provided through access ports to the annular space of the storage tanks. The two tanks also will have liquid-level monitors interlocked to the feed pumps to prevent overflow conditions.

The purpose of the interim storage tanks is to provide operational flexibility during testing. Some testing will not require use of the interim storage tanks at all. The tanks may not be cleaned or flushed in between tests because the waste to be tested is expected to be relatively homogeneous. If flushing of the tanks between tests is deemed necessary, the tanks will be flushed with either demineralized water or potable water, as appropriate. Tank flushing requirements would normally be given in the individual test procedure. A demineralized water line is currently available in the 1706-KE Building.

As an added containment control, the concrete floor of the waste water pilot plant area will have all drains sealed and will be coated with an epoxy resin sealer. The walls of the waste water pilot plant also will be sealed with an epoxy resin sealer. The sealing of the floor and walls will provide a third level of containment in the unlikely event of a breaching of the secondary containment or 'spraying' at a leak developed at a pipe joint. The epoxy products will be compatible with the waste.

Labels will be affixed to equipment in accordance with WAC 173-303-640(5)(d).

The structural integrity of the two 3,000 gallon (11,350 liter) tanks will be reviewed in accordance with the requirements of 40 CFR 264.192(b) and WAC 173-303-640(2)(c) before being placed in service and every five years after the date the tanks were put in service. In addition, the initial integrity assessment will include tank tightness tests in accordance with the requirements in 40 CFR 264.192(d) and WAC 173-303-640(2)(e). The results of the integrity assessments will be included in the waste water pilot plant operating record.

If either of the two 3,000 gallon (11,350 liter) tanks are found to be leaking or unfit for service, the tank must be immediately removed from service and the requirements of 40 CFR 264.196 and WAC 173-303-640(7) will be complied with. The tank will not be returned to service until the required certification has been obtained.

4.1.3 Waste Water Pilot Plant Ventilation System

The process area, process equipment, and interim storage tanks will be vented through the existing 1706-KEL Building ventilation system. This system has a rated capacity of 12,250 cubic feet (347 cubic meters) per minute at a static pressure of 4 inches (10 centimeters) of water vacuum. A flow diagram for the ventilation system is included in the waste water pilot plant process flow diagram presented in Figure 4-2 and Appendix 4A. The ventilation system also services a decontamination laboratory for Hanford Facility RCRA activities, where soil sampling equipment is cleaned. This decontamination laboratory is located in the 1706-KE Building and is independent of the pilot plant operations.

4.1.3.1 High Efficiency Particulate Filtration. The HEPA filter is made of a pleated, dry type media and constructed to seal with the filter housing to prevent any air from bypassing the filter. Nuclear facilities operated by the DOE require that the HEPA filters be tested for resistance and penetration by the manufacturer and again by one of the three quality assurance stations operated for DOE. When the filters are received at the Hanford Site, they are again tested by the Hanford Environmental Health Foundation. The filters are

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again tested by the operations contractor following installation. Once the filters are installed, they must meet the following criteria.

- Filter in-place leak test requirements. All filters shall remove at least 99.95 percent of dioctyl phthalate (DOP) or dioctyl sebacate (DOS) particles, ranging in size from 0.1 micron to 3.0 microns, with a mean particle size of 0.5 micron.

- The HEPA filter cartridges shall be replaced when continuous exposure rates exceed 1 rad per hour measured at 6 inches (15.2 centimeter) or when the pressure drop across the filter exceeds 4 inches (10.2 centimeter) water gage.

Primary HEPA filtration for the waste water pilot plant ventilation system is provided by a ventilation housing containing nine 24 inch by 24 inch (61 centimeters by 61 centimeters) HEPA filters in a parallel configuration. These are preceded by nine roughing filters of the same size and configuration, to minimize loading on the HEPA filters. The roughing filters are disposable filters of the same construction as household furnace filters. A second stage of HEPA filtration is provided by in-line HEPA filters installed in the waste water pilot plant area ductwork. The primary HEPA filtration system also services the RCRA equipment decontamination lab.

Projected source term values for radionuclide air emissions from the waste water pilot plant are given in Appendix 4B. The air emissions notification document has been submitted to and approved by the Washington State Department of Health.

4.1.3.2 Controls for Volatile Organics. Emissions of volatile organics are controlled in two ways; the waste water pilot plant will be engineered to minimize the potential for volatilization and activated charcoal will be utilized in the ventilation system for removal of volatile organics. Also, the amount of volatiles introduced into the pilot plant via the waste water and associated spikes, is controlled by the waste acceptance criteria outlined in Section 3.3.

Release of volatile organics along with volatile radionuclides and volatile inorganics (e.g., mercury, ammonia) to the ventilation system is possible during transfers of the waste water. To minimize the release of these components, and to maintain the integrity of the waste water composition to be studied, transfer points will be engineered to minimize volatilization. To minimize volatilization while filling the tanker, a fill tube extending to the bottom of the tanker will be used. Once the tanker arrives at 1706-KE Building, any receiving tank will also be bottom filled to control release of volatile components.

The first processing step at the 1706-KE Building will be to adjust the pH to a range of 5.0 to 6.5. At this pH, the ammonia will be converted to ammonium ion and will no longer be vulnerable to release. The adsorption of ammonia on charcoal is negligible. Other inorganics will have a vapor pressure of less than 1 millimeter of mercury at the maximum operating temperatures of the waste water pilot plant. As a result, these inorganics are not considered to be vulnerable for release.

The waste water pilot plant ventilation system will contain a charcoal adsorption system to control the escape of volatile organics to the environment. The capacity of this system is in excess of the amount of volatile organic chemicals that can be provided by the waste water and addition of spiking compounds. The charcoal adsorption units will be, at a minimum, commercially available 35 gallon (133 liter) drum units containing 110 pounds (50 kilograms) of activated charcoal (Tigg* Model N50 or equivalent). This size unit is preferred so that it can be placed into a 55 gallon (208 liter) drum overpack for disposal. Location of the activated charcoal units is shown in the process flow diagram (Figure 4-2).

Table 4-2 shows the design requirements for the charcoal adsorption system. The volatile organics characterized in Table 3-1 were identified, along with expected concentrations. From this data, and the conservative assumption that 100% of the 90% confidence interval expected concentrations will be volatilized, it was calculated that 1.6 pounds (0.72 kilograms) of charcoal would be required to control the volatile organic emissions for each 5,000 gallon (18,927 liter) tanker. This would mean that a single drum of charcoal would be adequate to control over 60 tankers, not including spiking chemicals. The amount of waste water to be treated at the pilot plant facility will not approach 60 tankers. Also shown, for reference, in Table 4-2 is the maximum calculated emission rate for each volatile organic if there were no charcoal controls present.

Portions of the feed stream may be spiked with added organics to test the efficiency of the unit operations at higher concentrations and for different compounds than normally found in the feed as described in Section 3.2. The tests conducted with the spiked waste usually will be of smaller volume than the 5,000 gallon (18,927 liter) tankers, with 1,000 gallons (3,785 liters) being the typical volume. Table 4-3 lists the design requirements for the charcoal adsorbers for the spiked waste. The design calculations assume a 1,000 gallon (3,785 liter) batch spiked waste with the maximum concentrations of the volatile organics listed in Section 3.0, Table 3-4 "Operation Envelope Maximum Concentrations". Again, the conservative assumption was made that 100 percent of the compounds will be volatilized. The calculated charcoal required for a batch under these conditions is 14 pounds (6.4 kilograms). Even with the very conservative assumptions, a single charcoal adsorber would have adequate capacity for over 7,800 gallons (29,000 liters) of maximally spiked waste.

A redundant charcoal adsorption system will be installed on the waste water pilot plant ventilation system. The charcoal units will be installed in series, so that if breakthrough occurs on the primary unit, a second unit will provide backup. A continuous organic vapor analyzer (Thermal Environmental Instruments Co. Model 52, or equivalent) will be used to sample the air stream after the first charcoal unit to detect any breakthrough of the charcoal. If

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*Tigg is a trademark of the Tigg Corporation.

breakthrough is detected, the primary charcoal unit will be removed and the secondary unit would become the primary unit. A fresh unit then would be installed as the secondary unit. Breakthrough of the first stage charcoal adsorber will be considered to be at 10 parts per million as shown on the organic vapor analyzer. The analyzer will be set to alarm at that point. Operations will be stopped within 24 hours of the alarm, and the adsorber changed out. Immediate shutdown is not necessary because of the redundant emission control provided by the second stage charcoal adsorber. In the event that the organic vapor analyzer indicates breakthrough when the pilot plant processes are not operating, but a tank inventory is present (e.g., weekend), the adsorber will be changed out within 72 hours. Without the processes operating, the loading will be minimal and protection is provided by the second stage adsorber. The 72 hour limit is based on limited craft availability during the weekend. Manufacturer's information on the organic vapor analyzer is presented in Appendix 4C.

4.1.3.3 Emission Monitoring Equipment. Stack effluent radionuclide content will be monitored with a particulate record sampler. These sampling systems remove a sample from the stack and pass the sample through a 1.9 inch (47 millimeter) filter. The sample flowrates are controlled by a rotameter, which is calibrated routinely. The record sampler filter will be collected monthly and analyzed for total alpha and beta/gamma activity.

The organic vapor analyzer is used to determine breakthrough of the first stage charcoal adsorber as described in Section 4.1.3.2. Because a redundant, second stage charcoal adsorber is located downstream of the analyzer, this analyzer does not directly monitor organic emissions to the environment. The organic vapor analyzer is a photoionization detector (PID) operating at a continuous sample flow rate of 0.1 cubic feet (3 liters) per minute. The operating range will be set at 0 to 100 parts per million with a resolution of 0.1 part per million. Because the analyzer is being used to determine the changeout of the first stage charcoal, and not to quantify emissions, a two point calibration will be accomplished utilizing zero and span calibration gases. The span gas will be 5 to 30 parts per million (5 to 30 percent of scale) of a volatile organic most representative of the vapors expected in the ventilation system and commercially available.

4.1.4 Waste Water Pilot Plant Capacity

The throughput of any operation at the waste water pilot plant will be nominally 5 gallons (19 liters) per minute which is the equivalent to 300 gallons (1,100 liters) per hour. The ultraviolet oxidation unit will operate at flow rates as high as 25 gallons (95 liters) per minute in the recycle mode, but have a 5 gallon (19 liters) per minute throughput. The 1706-KE process diagram is shown in Figure 4-2 and Appendix 4A. The waste water pilot plant can be operated with a maximum of 5,000 gallons (19,000 liters) per batch. This limit is based on the size of the tank trailer [5,000 gallons (19,000 liters)]. The test program will be structured to accommodate up to one 5,000 gallon (19,000 liter) batch per week [20,000 gallons (76,000 liters) per month]. A process rate of one tank trailer every two weeks is anticipated during normal operations. Storage capacity at the waste water pilot plant will include two 5,000 gallons (19,000 liter) tank trailers and two 3,000 gallon (11,000 liter) intermediate storage tanks for a total of 16,000 gallons (61,000 liters) of potentially available storage. Filtration equipment at LERF will be sized at 5 gallons (19 liters) per minute [300 gallons (1,100 liters) per hour)] or less for each of the three units, for a total of 15 gallons (57 liters) per minute. There will be no storage capacity associated with the LERF equipment.

The amounts of waste tested at the waste water pilot plant will exceed limits contained in the guidance document for research, development, and demonstration permits (EPA 1986a). The guidance document specifies limits of 400 kilograms (100 gallons) per hour through-put, 15,000 kilograms (4,000 gallons) per month for treatment, and 15,000 kilograms (4,000 gallons) for storage. The conversion of kilograms to gallons was made using factors of 2.2 pounds per kilogram and 8.34 pounds per gallon of waste.

The guidance limits for throughput (EPA 1986a) must be exceeded because 5 gallons (19 liters) per minute is the smallest process units that are commercially available. The flowsheet for the waste water pilot plant was developed around this 5 gallon (19 liters) per minute limit. The totals given for the amount of waste tested per month and the storage capacities are maximum values; actual operations are likely to be less. Normal operations at the waste water pilot plant will require storage of 5,000 gallons (19,000 liters) of waste.

4.1.5 Technologies to be Tested

The types of technologies that will be tested in the waste water pilot plant include the following:

- pH adjustment
- Organic removal (e.g., ultraviolet light mediated oxidation and granular activated carbon)
- Inorganic removal (e.g., reverse osmosis and ion exchange)
- Suspended solids removal (e.g., filtration).

Each of the technology types are summarized in the following sections. A general description of the technology, a description of the equipment to be used in testing, identification of the critical parameters of each technology, and a description of the safety features of each type of equipment are presented.

A summary of the critical parameters of each technology that will be part of the waste water pilot plant is presented in Table 4-4. Also presented is a more detailed description of the critical parameters and how the parameters affect the operation and safety of the equipment. The instrumentation typically used to monitor these critical parameters is specified in Table 4-4.

The control setpoints on Table 4-4 that activate feed pump shutdown will be verified by operations contractor quality assurance personnel before initial startup of the waste water pilot plant. The assessment will determine if the setpoints are set at, above, or below the level that will result in the hazard described in Table 4-4. The setpoints will be modified if the equipment is not found to be activated before the occurrence of a hazard. The EPA and Ecology will be notified in writing of the change in the setpoints on Table 4-4. These changes will not be considered modifications to the permit application.

The following discussion has been organized under treatment technologies. Where specific equipment has been identified for that technology, a discussion of that equipment is included. Generally, equipment to be used for testing will be supplied by vendors as off-the-shelf stock items.

4.1.5.1 pH Adjustment. A pH adjustment step is required to change the waste water chemistry to enhance the removal or recovery of desired contaminants by downstream process equipment, or to adjust the waste water pH to meet regulatory discharge limits.

The pH of the waste at both the 1706-KE Building and the LERF will be adjusted before treatment. The pH adjustment step is straight forward where an acid is metered into the waste water and thoroughly mixed. The pH adjustment equipment consists of instrumentation and hardware to decrease the process stream pH. This is accomplished in makeup vessels containing two well-agitated compartments.

4.1.5.1.1 Equipment Description. The feed material for the waste water pilot plant will be in the pH range of 7 to 11 requiring an automatic system for adding an acid in the precise amount to change the solution pH to a range of 5.0 to 6.5. This will be accomplished at the 1706-KE Building by metering 95 percent sulfuric acid into the feed stream, followed by a 115 gallon (435 liter) mixing vessel. The pH adjustment equipment is shown in Figure 4-2. As a result of adjusting the pH of the waste to 5 to 6.5 for process optimization, the waste will be compatible with all waste water pilot plant equipment and will not pose a threat to personnel due to corrosivity.

The mixing vessel used at the 1706-KE Building consists of two chambers separated by baffle plates to assure the maximum retention time of 20 minutes. The mixing vessel will contain 115 gallons (435 liters) of liquid, but has a total volume of 137 gallon (519 liters). The mixing vessel will be made of reinforced, 16-gage 304-L stainless steel with internal baffle plates that divides the vessel into two chambers, each yielding 10 minute resident times at a throughput of 5 gallons (19 liters) per minute. Each chamber will contain an agitator and pH analyzer. The pH analyzer in the first chamber will be used to control the acid flow.

The sulfuric acid will be fed from a 30 gallon (114 liter) tank, with two check valves on the feed line to assure that the water can not leak back into the acid feed tank. The average flow rate of acid will be 0.5 ounces (16 milliliters) per minute for the 5 gallon (19 liter) per minute waste water pilot plant feed.

The mixing vessel for the pH system used at the LERF will be of the same construction, except for size. The vessel at the LERF has a total volume of 374 gallons (1,416 liters) and will normally hold 300 gallons (1,136 liters). The extra volume is required to maintain the retention time necessary for mixing at the increased flowrates used at the LERF. This vessel will be constructed of 304L stainless steel plate 3/16 inch (4.8 millimeters) thick.

4.1.5.1.2 Critical Parameters and Safety Features. A critical operational parameter is the correct volume addition of the acid to reach the desired pH. Controllers will activate and adjust the metering pumps depending on the pH signal received from the mixing vessel. The pH of the waste water at each step of the pH adjustment process will be monitored using online pH instrumentation. The pH also will be verified in the laboratory to ensure that the online instrumentation is working properly.

The pH instrumentation in the second compartment will be used to monitor the pH of the stream. The instrumentation will be tied into the alarm panel and set to alarm at a lower limit of 4 and an upper limit of 7. The process will be shut down if the pH is lower than 3 or higher than 8. The alarm setpoint values were chosen because at the upper limit of 7, about 0.5 percent of the incoming ammonia/ammonium would be present as dissolved ammonia. At a pH of 6.5, the ammonia represents about 0.2 percent of the ammonia/ammonium. In this pH range, temperature (from freezing to boiling) has a negligible effect on the ammonia/ammonium distribution. A lower alarm limit of 4 would ensure that the ultraviolet oxidation remains at an optimal performance regime. The alarm setpoints are to optimize system performance and do not present a corrosivity problem. Shutdown of the system at the limits of 3 and 8 is taken as a precautionary measure to prevent corrosion problems.

The pH adjustment step will involve handling strong acids. A critical safety parameter is corrosion of the feed system. The acid feed tank, transfer lines, and metering pumps will be constructed of materials compatible with the chemicals to minimize corrosion (e.g., 304-L stainless steel or high-density polyethylene).

To assure containment, a liquid level switch in the mixing tank will shut down the feed pump to prevent overflow. Secondary containment will be a catch pan under the entire assembly, as described in Section 4.1.2.

The acid feed line will contain two check valves to prevent water from entering the acid feed tank. Chemical addition will use the waste water in the tank as a heat sink for any increase in temperature because of the heat of solution.

Tanks in the pH adjustment will be vented to the ventilation system.

4.1.5.2 Organic Removal. Organic compounds can be destroyed by using ultraviolet oxidation to convert organics to carbon dioxide and water. When an oxidant, such as hydrogen peroxide or ozone, is acted upon by ultraviolet light, a hydroxyl radical is formed that is a very reactive oxidant. This hydroxyl radical is used to oxidize the organics. The degree of organic oxidation depends on the residence time of the waste water in the ultraviolet reactor, the concentration of oxidant, and the intensity of the ultraviolet light source.

Granular activated carbon also may be used for removal of organic constituents. The equipment, critical parameters, and safety features are similar to ion exchange and are discussed with ion exchange in Section 4.1.5.3.2.

4.1.5.2.1 Equipment Description. The ultraviolet oxidation unit is a Perox-pure Model SSB-30 from Peroxidation Systems, Inc. The unit is skid mounted and contains a 316 stainless steel reaction vessel, hydrogen peroxide addition system, chemical resistant feed pump, and electrical power and control panels. The physical dimensions of the oxidation unit are approximately 3½ feet (1.1 meter) wide by 5 feet (1.5 meter) long by 6½ feet (2 meters) high, with a minimum of approximately 8 feet (2.4 meter) wide by 9½ feet (2.9 meter) long by 6½ feet (2 meters) high for maintenance on the electrical and control panels and for changing the ultraviolet lamps.

The ultraviolet oxidation piping and instrumentation diagram is presented in Figure 4-3. Figures 4-4 and 4-5 present elevation and plan views of the ultraviolet oxidation equipment. The oxidation unit has a reactor volume of approximately 30 gallons (114 liters) and is equipped with six ultraviolet lamps rated for 5 kilowatts each. The lamps are mercury vapor lamps, and are considered high intensity. Other vendors use low intensity lamps that are rated from 14 watts to 65 watts. A quartz sheath protects the lamps from the waste water solution. The six lamps have individual switches so any number of lamps can be activated at any one time. The reactor outlet acts as the vessel vent when filling the equipment and any gas generation during operation will be swept out the outlet piping of the unit to a vented storage tank. The equipment can be operated in a once-through mode or in a recycle mode. Hydrogen peroxide will be added to the ultraviolet oxidation reactor using a metering pump and will be injected into three areas of the reactor.

4.1.5.2.2 Critical Parameters and Safety Features. There are several safety features on the equipment that monitor critical parameters and cause an alarm, for which a response is required. The response to an alarm could be to shut the system down, either automatically or manually, or to investigate the problem. The alarm condition is shown on the control panel. The critical parameters require the following safety systems.

- The reactor has a pressure limit of 20 pounds per square inch gage (137 kilopascals). If the pressure in the reactor exceeds 20 pounds per square inch gage (137 kilopascals) a graphite rupture disk will split. When the rupture disk splits, a flow switch in the rupture disk line will cause an alarm to annunciate. The line on the rupture disk returns to the feed tank. A pressure switch located on the pump discharge will deactivate the pump at approximately 15 pounds per square inch gage. This pressure switch reduces the chances for excessive pressure in the reactor and provides redundant pressure control in the reactor.

- There is a positive seal around each end of the quartz sheathes to eliminate leakage past the sheath. If moisture does leak past the seal around the quartz sheath, a moisture sensor causes an alarm to annunciate.

- Flow and pressure sensors are located in the influent waste water line. If the sensors indicate no flow, an alarm annunciates. A pressure sensor is located in the hydrogen peroxide injection line to make sure there is oxidant flowing into the reactor. If this sensor indicates reduced pressure, the alarm annunciates.

- A limit switch on the lamp enclosure door causes the alarm to annunciate when the door is opened while the lamps are powered. The switch would also turn the lamps off.

- There are high temperature sensors [150 °F (66 °C)] for the liquid effluent that will cause an alarm to annunciate. The liquid temperature sensor will help preserve the integrity of the reactor due to overheating.

Other safety features in the ultraviolet oxidation unit are as follows.

- A cooling fan provides cooling for the lamp ballasts to prevent overheating.

- The view ports in the reactor are designed to filter the intense ultraviolet light to prevent eye damage to operators.

- The hydrogen peroxide injection system consists of redundant metering pumps with check valves and ball valves on both sides of each pump, and an additional spring loaded ball check valve to act as an antisiphon valve at the chemical injection ports. These hydrogen peroxide safety features will reduce operator contact and possible spillage when changing or maintaining the metering pumps and prevent waste water from entering the hydrogen peroxide lines.

- The ultraviolet oxidation unit has a bottom drain to thoroughly drain the unit.

4.1.5.3 Inorganic Removal. Reverse osmosis and ion exchange are the two types of inorganic removal discussed in the following sections. Granular activated carbon requires similar equipment to ion exchange and is discussed with ion exchange.

4.1.5.3.1 Inorganic Removal-Reverse Osmosis. Reverse osmosis is a technology that employs pressure to effect a separation of a solute (contaminants) and a solvent (water). The pressure applied must be great enough to overcome the natural osmotic pressure of the solution. The solution is passed over the surface of a semi-permeable membrane, with an applied pressure of between 100 to 700 pounds per square inch gage (689 to 4,826 kilopascals).

The membrane pore size, composition, surface charge, and thickness, permit the water molecules to preferentially diffuse through the membrane while retaining the contaminant molecules (principally inorganics) in a concentrated waste solution. This concentrated waste solution, which does not pass through the membrane, is called the retentate or concentrate stream, and the portion that passes through the membrane is called the permeate stream. The retentate stream can be processed through several membranes in series to recover more of the waste water as permeate. Likewise, the permeate can be processed through several membranes to increase permeate purity.

Reverse osmosis does have a limitation as to how much separation can occur. This limiting factor depends on the solubility of the inorganic contaminants and the flowrate. When the solubility point is reached for a certain inorganic compound, a precipitate will form. If the flowrate is not adequate there will be a decrease in the effectiveness of the reverse osmosis operation by fouling the membrane. In most cases chemicals can be used to restore the membrane to the same condition as before fouling.

4.1.5.3.1.1 Equipment Description. The main test apparatus is a 12 gallon (45.2 liter) per minute reverse osmosis unit manufactured by Applied Membranes, Inc. This system uses spiral wound, tangential flow, thin film composite membranes. These membranes are anticipated to offer the highest strength and excellent permeate volume generation when compared to hollow fiber and plate and frame configurations. The unit uses FT-30 series thin film composite membranes manufactured by Filmtec, Incorporated. The membrane cartridges are 4 inches (10.2 centimeters) in diameter and 40 inches (101.6 centimeters) long. The reverse osmosis unit dimensions are approximately 16½ feet (5.03 meters) long, 4½ feet (1.37 meters) wide and 6½ feet (1.98 meters) high. The unit has two stages with four pressure vessels in the first stage and three pressure vessels in the second stage. Each pressure vessel can contain three membranes. Membrane spacers can be used in pressure vessels when less than three membranes are needed. A flow schematic and piping and instrumentation diagram of the system is presented in Figure 4-6.

The retentate from each stage can be recycled back to a preceding stage. This recycle increases the velocity over the membranes and minimizes the retentate volume. The system is designed to provide flexibility on how much retentate is recycled and to where it is fed. A portion of the retentate from stage 1 is returned to the influent of stage 1, second array. The retentate from stage 2 is returned to the influent of stage 1. Retentate is discharged from stage 1 and treated as secondary waste. The high velocity resulting from recycling the retentate will help to minimize fouling by sweeping away precipitate or biological material off the membrane surface. This increases the membrane surface area available for pure water to pass through.

The reverse osmosis unit contains all the piping, pumps, monitoring equipment, instrumentation, and chemical feed equipment necessary for operation. All pressure vessels, housings, and piping are stainless steel for chemical resistance. Flow, conductivity, and temperature instruments are stainless steel. The pH probes are polypropylene and provide adequate resistance to all chemicals in these tests. Pressure gages are liquid filled for shock absorbance.

The system instrumentation permits data collection from initial feed and final permeate and retentate points, and also from intermediate points to give online evaluation of the performance of individual stages. All instruments except pressure gages have 4 to 20 milliamperes output so data can be logged automatically. All instruments have continuous readouts located on a central panel board. The control panel is shown in Figure 4-7.

The reverse osmosis unit contains approximately 50 gallons (189 liters). A catch pan will be placed under the entire unit to provide secondary containment in case of any leaks or spills. No gases will be generated during reverse osmosis operation.

4.1.5.3.1.2 Critical Parameters and Safety Features. Pressure is the most critical parameter in the reverse osmosis system. Pressure provides the driving force to concentrate the waste stream by 'pushing' water through the membrane. The operating pressure of reverse osmosis is nominally 200 to 550 pounds per square inch gage (1,379 to 3,792 kilopascals). Pressure regulating valves are provided to control the desired operating pressure. The system is specified for operation up to 700 pounds per square inch gage (4,827 kilopascals).

Spray containment for the reverse osmosis module will be provided by a housing constructed of clear plastic panels (e.g., plexiglass) hung from the existing module framework (extended where necessary). The panels will be approximately 4 foot (1.2 meters) wide and will be removable for maintenance on the module. The bottom of the panels will extend to just inside the catch pan walls. Fans may have to be installed to provide for ventilation of the module.

Flow rate also is an important operating parameter. Adequate flow over the membranes is important to keep the membranes clean and fully functional. Flow control valves are provided so proper flow rates can be maintained.

Temperature is another important parameter. Temperature affects the flux (permeate generation rate per membrane surface area) and the purity of the permeate stream. The system is designed for an operating temperature of 86 °F $\pm$27 °F (30 $\pm$15 °C). This range is sufficient for the waste water pilot plant operation. Should the operating temperature exceed 104 °F (40 °C), the integrity of the membranes could be compromised by reducing the effective membrane life. However, no safety hazards are presented to the operating personnel.

There are two conditions that will shut down the system. The conditions are high and low pressure. When either of these conditions are met, the high pressure reverse osmosis pumps are shut down along with the feed pump. The high pressure shutdown is adjustable with a maximum of 700 pounds per square inch gage (4,827 kilopascals). This will prevent equipment damage and leakage. The reverse osmosis stainless steel pressure vessels are over designed to a pressure rating of 1,000 pounds per square inch gage

(6,895 kilopascals). The pump inlet low pressure switch is adjustable and will shut down the pump to prevent cavitation damage to the pump.

Several other safety features are designed into the equipment. All pump shafts, motor shafts, and couplings have a protective shield to protect personnel from moving parts. The control panel contains all pump controls and instrumentation for monitoring the condition and state of the equipment.

4.1.5.3.2 Ion Exchange and Granular Activated Carbon. Ion exchange and granular activated carbon will be considered together because the required test equipment and the critical parameters are very similar. The ion exchange or granular activated carbon processes act to concentrate the contaminants on the ion exchange or granular activated carbon media. The ion exchange resin and granular activated carbon can be used for polishing of the waste water. The granular activated carbon also can be used as an initial organic removal step.

The ion exchange process involves removing dissolved solids, including radionuclides, as ionic species from the waste water and binding the ions to a ion exchange media. The resin media is usually in the form of small beads. For continuous processing on a pilot plant scale, the ion exchange resin is placed in a cylindrical vessel assembly called an ion exchange bed. There could be several ion exchange beds placed in parallel or in series depending on the application. A flow distribution system within the ion exchange bed produces uniform waste water flow through the adsorption media. Uniform flow through an ion exchange bed is important to uniformly deplete the ion exchange resin to provide efficient use of the ion exchange resin capacity. The ion exchange bed can be regenerated to return the ion exchange resin to a state where the ion exchange again will remove contaminants. Regeneration of ion exchange resin is performed by using either an acid or base, depending on the resin, and passing the acid or base through the ion exchange resin bed. The concentrated contaminants are removed into the regeneration solution. This regeneration solution is handled as a secondary waste.

The granular activated carbon primarily is used to remove organic contaminants from water. The organic species are adsorbed physically and retained on the granular carbon particle. The method of handling and using the granular activated carbon is very similar to ion exchange resins, except granular activated carbon is regenerated in a different manner.

4.1.5.3.2.1 Equipment Description. The ion exchange and granular activated carbon waste water pilot plant equipment will be laboratory bench scale. Both batch and continuous flow testing will be performed using actual waste water. In most cases the waste water will be obtained as the effluent from reverse osmosis testing. However, the feed sample point may be varied. As an example, 'as received' or pH adjusted waste water may be tested to determine the capability of granular activated carbon to remove organics in place of ultraviolet oxidation. All testing will be performed in a laboratory hood at the 1706-KE Building.

The ion exchange and granular ultraviolet activated carbon equipment will be very similar. The ion exchange resin may be regenerated. Regeneration would be accomplished using dilute sulfuric acid and/or dilute sodium hydroxide, followed by a deionized water rinse. The spent regeneration and rinse waters will be considered secondary waste and disposed according to approved operating procedures. No granular activated carbon regeneration is planned. Figure 4-8 is a sketch of the batch and continuous flow test equipment.

Ion exchange and granular activated carbon batch testing will consist of shaking a mixture of the media and waste water in small bottles [approximately 1.7 ounces (50 milliliters)] for a set time (Figure 4-8). This provides intimate mixing of the media and waste water and allows the adsorption process to come to equilibrium. The testing will provide a preliminary evaluation of media performance characteristics. These characteristics are then used to select the most promising media for further testing in a continuous column. These characteristics also are used to determine the size of the column appropriate to the desired flow rate.

The ion exchange and granular activated carbon continuous flow equipment will be sized to a flow rate of less than 1 gallon (3.8 liters) per minute. The ion exchange or granular activated carbon column will either be a chromatography column or a stainless steel pipe with fittings at each end. The column will have a fine mesh screen at each end to prevent the adsorption material from escaping the column. The column diameter will vary according to the test objective. Column sizes will be 2 inches (5.1 centimeters) or less in diameter. A metering pump will be used for the continuous feed testing.

4.1.5.3.2.2 Critical Parameters and Safety Features. Handling of waste water, dilute sulfuric acid, and dilute sodium hydroxide present potential safety and environmental contamination concerns. All testing will be conducted within a laboratory hood using standard chemical and radiological laboratory practices. A drip pan will provide secondary containment for the test equipment.

4.1.5.4 Suspended Solids Removal. The waste water pilot plant filtration testing will be performed at the 1706-KE Building and at the LERF. The purpose of testing filtration is to identify a filter or filters that can successfully remove the suspended solids (grit, colloids, biological growth, etc.) from waste water. The removal of these solids is essential for the protection of the downstream treatment systems and for the removal of other contaminants (e.g., organics, inorganics). A successful filter will be identified as one that is capable of maintaining a design flow rate with a minimum generation of secondary waste and fouling.

4.1.5.4.1 Equipment Description. The three filter systems currently planned for testing include tubular polymeric ultrafiltration with sponge ball wash out, polymeric backwashable ultrafiltration, and centrifugal ultrafiltration.

Figure 4-9 illustrates the proposed location of the LERF filtration equipment. The filtration waste water pilot plant equipment will be skid mounted and set next to the LERF. The waste contained in the LERF will be pumped to the pilot plant equipment through a LERF sample port using a submersible pump. After passing through the filtration equipment, the waste will be returned to the LERF via a second sample port. All filtration equipment vents to an inflatable bladder and results in no air emissions. The locations of the selected sample ports are shown in Figure 4-9. The LERF filtration flow diagrams are presented in Figures 4-10, 11, 12, and 13.

The tubular polymeric ultrafiltration system, as shown in Figure 4-11, consists of 4 membrane modules, each containing a polymeric membrane that allows water to pass through the membrane while concentrating the particulates. This system is operated at a high velocity within each tube that acts to clean the polymeric membrane. The waste water is fed to a staging tank (the exact size is not yet defined); from there the waste water is pumped to the tubular filters. Specially designed sponge balls will be added periodically to clean the polymeric membrane.

The centrifugal ultrafilter flow diagram is shown in Figure 4-12. The centrifugal ultrafilter is a membrane-based filtration system made up of sandwiched, cylindrical disk packs. The disk packs are multi-layered and consist of a porous filler, such as fiberglass cloth, and a stiffener packed between two sheets of ultrafilter membrane material. The disk pack membranes are separated one from the other using a spacer.

To prevent fouling, the disk packs are rotated at 1,000 revolutions per minute creating a shear force of 300 g's at the membrane surface. This high shear force results in minimal membrane surface/particle interaction. It was this feature that prompted selection of this technology.

The polymeric backwashable ultrafiltration system, shown in Figure 4-13, consists of a filter housing containing a polypropylene filter. The filter is backwashed on a pressure differential cycle as follows:

1) The automatic opening of a bottom drain valve and startup of a backwash pump from a vessel containing filtered water

2) The pump pressure forces the liquid backwards through the filter dislodging any particulate material from the filter media

3) The filtrate vessel drain valve automatically closes and the backwash pump shuts off, stopping the backwashing process.

The pressure vessel is filled with filtrate again in order to be ready for the next backwash cycle. The particulate material can be discharged through a port at the base of the filter housing. The pressure required to backwash the filter is about 50 to 80 pounds per square inch gage (345 to 552 kilopascals). The pressure is measured in the inlet and outlet side of the filter.

The filtration module at the 1706-KE Building also will be a polymeric backwashable filter as described previously. At the 1706-KE Building, an equalization tank is not needed. The flow diagram for the 1706-KE Building filtration system is shown in Figure 4-14. The primary function of the filtration equipment at the 1706-KE Building is protection of downstream equipment. Therefore, turbiditimeters will not be included on the 1706-KE Building equipment.

4.1.5.4.2 Critical Parameters and Safety Features. The critical operating parameters for filtration are pressure and temperature. The filtration equipment will be operated at a maximum 150 pounds per square inch gage (1,034 kilopascals) and will be fully pressure tested before processing waste water. The temperature can affect the performance of the polymeric filter assemblies or membranes. The one polymer identified so far is polypropylene, which has a maximum operating temperature of about 176 °F (80 °C).

The following are safety features that will be built into the filtration systems. The detailed safety features are only conceptual at this time. Pressure switches are installed to avoid equipment failure and damage at low pressure and high pressure. Pressure relief valves will be used as a backup safety feature for the high pressure switch. Thermocouples will monitor the system temperature so that the operational temperature of the filter material is not exceeded. High- and low-level switches on all staging tanks alarm to prevent tank overfilling and as a backup to the low pressure switch to prevent running a pump dry.

The waste water pilot plant filtration equipment will be designed to meet the secondary containment requirements of WAC 173-303-640. The waste water pilot plant filtration equipment will have welded pipe joints where possible, catch pans, and pump interlocks. Piping will be pressure tested before processing waste water.

Each LERF filtration module will be provided with a weather-tight enclosure to prevent the accumulation of rainwater in the catch pan and its consequent drainage to the LERF. These enclosures will also serve as spray guards for containment of any leak of the module equipment.

The filtration module at the 1706-KE Building will have either a clear plastic enclosure such as that described in 4.1.5.3.1.2 for the reverse osmosis module, or, sheet metal or plastic spray deflectors around each non-welded pipe connection.

4.2 WASTE WATER PILOT PLANT TESTING AT THE LIQUID EFFLUENT RETENTION FACILITY

Pilot plant testing of several filtration systems will be carried out at the LERF as described in Section 4.1.5.4. To support filtration testing, a pH adjustment step will be carried out as described in Section 4.1.5.1. The testing will be conducted at the site to minimize sample transport and the impact on the particulate characteristics.

4.3 WASTE TRANSPORTATION AND TRANSFER OPERATIONS

Waste water pilot plant testing at the 1706-KE Building of the 242-A Evaporator process condensate stored in the LERF will require that the waste water be transferred back and forth between the LERF and the 1706-KE Building. The transfer will be routed over Hanford Facility roadways over a distance of approximately 10 miles (16 kilometers) (one way). The transfers will use two tank trailers.

The following sections describe the transfer process, road and waste routing, tank trailers, and the waste unloading and loading areas at the LERF and the 1706-KE Building. The actual transportation of the waste between the LERF and the 1706-KE Building is not performed by the waste water pilot plant and is not included within the scope of this permit application.

4.3.1 Transfer Process Description

Transfers will be accomplished using two 5,000 gallon (18,927 liter) tank trailers. The tank trailers will be pulled by tractors operated by certified drivers. These single-walled tank trailers are built to U.S. Department of Transportation Specification MC-312-SS, and modified to meet waste water pilot plant requirements. The tankers are certified for the transport of hazardous liquids over U.S. public highways (copy of certificate is provided in Appendix 4D).

The waste requiring transport to the waste water pilot plant is the 242-A Evaporator process condensate. The 242-A Evaporator process condensate will be stored at the LERF until the 242-A Evaporator/PUREX Plant Process Condensate Treatment Facility is operational. This is a dilute aqueous liquid containing low levels of suspended solids, dissolved solids, and organics. A fraction of the suspended and dissolved solids are radioactive. The waste has a radioactive waste classification of low specific activity (LSA) per 49 CFR 173.403(n).

At LERF, the waste will be loaded into the tank trailers using a submersible pump lowered down an existing LERF Basin 43 riser. The riser connects LERF Basin 43 to the existing LERF catch basin. There will be continuous operator surveillance of the loading lines and the tank liquid level during filling. Unloading of the waste at the LERF after testing will be accomplished using a pump mounted over the existing LERF catch basin.

Unloading at the 1706-KE Building will be accomplished using a self-priming pump located over a catch tank at the waste load/unload station located northwest of the 1706-KE Building. Loading of the waste into the tank trailer after testing will be accomplished using internal 1706-KE Building process pumps. These process pumps will be interlocked to the liquid level instrumentation of the tank trailer to prevent overfill.

Onsite waste transfer sheets will be used to document the transfer-out and transfer-in of the waste at the LERF basins.

4.3.2 Road and Waste Routing Description

Drawing H-2-958 in Appendix 1A and Figure 1-1 show the major roadways on the Hanford Site. These routes are classified as either primary or secondary routes. The primary routes are constructed of bituminous asphalt [usually 2 inches (5.1 centimeters) thick, but the thickness of the asphalt layer will vary with each road] with an underlying aggregate base in accordance with U.S. Department of Transportation requirements. The secondary routes are constructed of layers of oil and rock mixture with an underlying aggregate base. The aggregate base consists of various types and sizes of rocks found onsite. Currently, no load bearing capacities are available; however, loads as large as 140 pounds per square inch (9,9 kilograms per square centimeter) have been transported without observable damage to road surfaces. All roads meet the requirements for the American Association of State Highway and Transportation Officials HS-20-44 load rating (AASHTO 1983). An HS-20-44 loading represents a two-axle tractor [front loading of 8,000 pounds (3,633 kilograms) and rear-axle loading of 32,000 pounds (14,535 kilograms)] plus a single-axle trailer with a 32,000 pound (14,535 kilogram) axle loading. The tractor and the trailer hauling waste to the waste water pilot plant will have three axles on the tractor and double axles on the tank trailer. The estimated load per axle of the loaded tractor trailer combination will be well below the AASHTO rating of 32,000 pounds (14,535 kilogram) per axle.

The waste routes from the LERF to the 1706-KE Building are shown on Figures 4-15, 4-16, and 4-17. Waste will travel from the 1706-KE Building to the LERF by reversing the routes shown. Except as noted, the roadways meet the requirements of primary or secondary routes. The tank trailer will be loaded at the northwest corner of the LERF Basin 43 and proceed out of the LERF fenced area to Camden Avenue as shown in Figure 4-16. Within the LERF fenced area, the roadway will be at a minimum, a minus 2-inch (5.08-centimeter) boulder gravel road. This surface is deemed adequate for the infrequent, short-term use that is anticipated to support the waste water pilot plant testing program. A crushed gravel surface might be applied to the roads within the fenced area at the LERF.

From Camden Avenue, the waste will be routed through the 200 East Area using primary and secondary road surfaces. The routing through the 200 East limited access area will be via the most direct or convenient route. Two such routes are shown in Figure 4-15. Both routes proceed north on Camden Avenue to the north end of the 200 East Area. One route turns west on the perimeter fence road and parallels the 200 East north fence, then proceeds south through Gate 815 (manned 24 hours a day) to Route 4 South. Route 4 South joins Route 4 North near the southwest corner of the 200 East Area. The other route (Figure 4-15) proceeds north on Camden Avenue through Gate 810 to Route 11A (a 4-lane divided highway). The waste will be transported west on Route 11A to Route 4 North. Gate 810 is normally locked and passage through the gate requires Hanford Patrol permission.

The waste is transported north on Route 4 North, then west on Route 1, then northwest on the 100K access road to the 100K perimeter fence (Figure 4-15). The waste proceeds northwest, through an unmanned gate, into the 100K Area (Figure 4-17). The waste is transported north through a second, gate (manned 24 hours a day) into the 100K limited access area. The waste is routed northeast to the 1706-KE Building load/unload area.

4.3.3 Equipment Description

The equipment required for transporting the waste to and from the LERF consists of the tank trailers, and the loading and unloading equipment at the LERF and 1706-KE Building.

4.3.3.1 Tank Trailer. A side elevation of the tank trailer is presented in Figure 4-18. Each of the two identical tank trailers consist of a nominal 5,000 gallon (18,927 liter) horizontal cylinder 37 feet (11.3 meters) in length and 57.17 inches (145.2 centimeters) internal diameter, with 8-gage wall [0.1644 inch (0.418 centimeter) nominal thickness]. The dished heads have minimum wall thickness of 0.1255 inch (0.318 centimeter). Material of construction is 316 stainless steel. The tank trailer is U.S. Department of Transportation certified to carry corrosives, acids, and caustics. The waste water processed in the pilot plant will not approach the operating limits of the tank trailer.

Per 49 CFR 173.425(c)(2)(ii), the tank trailer has no bottom unloading capability. The only tank penetrations are located on the top centerline of the tank. These penetrations are enclosed by drip pans that are an integral part of the trailer (Figure 4-19). The penetrations are for the following equipment:

- 2-inch (5.08-centimeter) diameter load-in/load-out port with a dip tube extending into an 8.25 inch (21 centimeter) diameter sump in the bottom of the tank; the port is equipped with a ball valve and valved quick-disconnect; the port is located near the rear of the tank

- 2-inch (5.08-centimeter) flanged port with a 1/2-inch (1.3-centimeter) dip tube for liquid-level instrumentation; the dip tube is equipped with a ball valve and valved quick disconnect for liquid level instrumentation; the port also has a 3/4-inch (1.91-centimeter) capped sample pipe teed to a pressure gage and a vacuum relief device set to open at 0.5 to 5 inches (1.3 to 12.7 centimeter) of mercury; the port is located in the rear third of the tank

- 20-inch (50.8-centimeter) diameter manhole secured with wing nuts and security wiring; the manhole is located in the rear third of the tank

- 2-inch (5.08-centimeter) diameter vent port with ball valve and valved quick-disconnect; the vent port is located near the center of the tank

- 4-inch (10.2-centimeter) diameter load-out port with dip tube extending down into an 8.25-inch (20.9-centimeter) diameter sump in the tank bottom; the load-out port is equipped with a ball valve and valved quick-disconnect, located in the center of the tank; this port is not planned for use during waste water pilot plant operations

- 2-inch (5.08-centimeter) diameter port for American Society of Mechanical Engineers (ASME 1989) high pressure rupture disk [52 pounds per square inch (358 kilopascals)]; the port is located near center of the tank.

4.3.3.2 Waste Load/Unload Station at the LERF. Tank trailer loading and unloading operations will take place at the LERF load/unload station. The load/unload station will be located adjacent to the existing catch basin for LERF Basin 43. The load/unload station will utilize the catch basin and utilities wherever possible. Secondary containment will be provided as specified in WAC 173-303-630 and 640. The following sections describe tank trailer loading and unloading at the LERF.

4.3.3.2.1 Waste Loading at the LERF. The waste water will be transferred out of the LERF basin 43 using a submersible pump lowered down one of the existing emergency pumpout risers. The emergency pumpout riser terminates in the LERF catch basin (Figure 4-20). The discharge line from the pumpout riser will quick-connect to an all welded load/unload line that will run from the LERF catch basin along an overhead piping support structure (Figure 4-21). The support structure will be located over the position where the tank trailer will be spotted for both loading and unloading. At the outer end of this structure, the line will terminate in a flex hose. The terminal end of this flex hose will quick-connect to the load/unload port on the tank trailer. The on/off controls for the pump will be located at the load/unload station.

The tank trailer ventilation system at LERF will use a 35-gallon (133-liter) drum carbon adsorber (Tigg Model N50 or equivalent) to control volatile organic emissions to the environment during loading (Figure 4-21). A flexible hose with a quick connector at the terminal end will be used to make the connection to the tank trailer vent port. The flexible hose will be connected to a pipeline supported by the overhead piping support structure. The pipeline will run to a 35-gallon (133-liter) drum carbon adsorber located over the LERF catch basin. The adsorber will vent to atmosphere. This ventilation line configuration will be the same for both loading and unloading of the tank trailer at LERF.

Gaseous discharge from the 35-gallon (133-liter) drum carbon adsorber will be monitored during trailer loading and unloading using a portable volatile organic analyzer (HNU* Model PI-101 or equivalent). Vendor information on the HNU Model PI-101 is included in Appendix 4C. An analysis is included in Appendix 4F that shows the concentration of volatile organic compounds to the carbon adsorber during filling of the tank trailer will be a maximum of 40 parts per million. The volatile organic concentration in the effluent air from the carbon adsorber before breakthrough will be virtually zero. When breakthrough is reached, the volatile organic concentration in the waste water will rise fairly rapidly to the inlet concentration. Although the detection limit of the HNU analyzer is reported as 0.2 parts per million using a benzene and air matrix as the calibration gas, it is necessary to set the

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*HNU is a trademark of HNU Systems Incorporated.

breakthrough level sufficiently above the instrument detection limit to eliminate false indications of breakthrough. On this basis, an ascending level that exceeds the value of 10 parts per million will be considered an indication of breakthrough. The time-weighted average (TWA) values for an 8-hour worker exposure limit are 250 parts per million for acetone, and 50 parts per million for 1-butanol (NIOSH 1985). If breakthrough of the adsorber is detected, the filling operation will be shutdown and the carbon adsorber replaced.

Bottled nitrogen gas maintained at the LERF catch basin will be supplied to the tank trailer for use in liquid-level indicator. The nitrogen line will be run up and over the tank trailer using the piping support structure described above (Figure 4-21). A terminal end flexible hose with quick-connect fitting will make the final connection to the tank trailer bubble pipe (liquid-level detector) port. This same line configuration will be used for both tank trailer loading and unloading. The liquid-level indicator output will be located at the load/unload station.

4.3.3.2.2 Waste Unloading at the Liquid Effluent Retention Facility. For unloading, the tank trailer will be spotted at the same location as during loading. The ventilation and liquid-level instrumentation connections will be the same as for loading. Also, the waste water connection at the tank trailer will be the same as for loading. The unloading pump will be located on a platform lying above the LERF catch basin. For unloading operations, the waste water line from the tank trailer will be quick-connected to the inlet of an unloading pump (Figure 4-21). The discharge of the unloading pump will be piped to a second LERF Basin 43 riser in the LERF catch basin (Figure 4-20). The on/off controls for this pump will be located at the load/unload station.

4.3.3.2.3 Containment and Surveillance at the Liquid Effluent Retention Facility Load/Unload Station. The piping from the flex hose to the LERF catch basin will be aboveground, all-welded, and hence does not require secondary containment. The LERF catch basin will provide secondary containment for the piping and the pump at the LERF basin (Figures 4-21 and 4-22). The LERF catch basin will have a drain leading back into the LERF 43 basin.

Secondary containment will be provided for the tank trailer, waste water load/unload flex hose, and connector through the use of a portable berm. The secondary containment structure selected for use is the SpilGard[a] portable berm manufactured by ModuTank Inc. The portable berm is discussed in detail in Section 4.3.3.4. A custom-made SpilGard will be used at the LERF. This portable berm will be a single-wide unit that is 11 feet 9 inches (3.6 meters) wide, by 58 feet (17.7 meters) long, by 2 feet (0.6 meters) deep. The berm will have a single end gate through which the tractor trailer will be backed into the berm for loading or unloading. The length will allow the tractor to remain connected to the tank trailer during waste loading or unloading activities.

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[a]SpilGard is a trademark of ModuTank Inc.

The portable berm unit at the LERF will have a capacity of 10,200 gallons (38,600 liters). The berm will have the capacity to contain the full contents of the 5,000 gallon (18,900 liter) tank trailer plus more than sufficient capacity to contain the 637 gallons (2,411 liter) that could result from a 25-year, 24-hour storm as required by WAC 173-303-630(7). The 25-year, 24-hour storm event is calculated to deliver 1.5 inches (3.8 centimeters) of rain. Precipitation data were obtained from the U.S. Weather Bureau *Rainfall Frequency Atlas of the United States* (U.S. Weather Bureau 1961, p. 101).

The loading and unloading processes at the LERF each will take less than 4 hours. An operator and health physics technician will provide continuous surveillance during these operations. Local tank trailer liquid-level indication will be available continuously and the load or unload pump will be locally shut down promptly at any sign of leakage. The portable berm and single-encased piping will be inspected at least every 24 hours.

4.3.3.3 Tank Trailer Unloading and Loading at the 1706-KE Building. The waste load/unload station will be located across the street and northwest of the 1706-KE Building (Figure 4-23). The load/unload station will accommodate two tank trailers simultaneously. One tank trailer will provide waste feed to the waste water pilot plant. The other tank trailer will accumulate waste from the waste water pilot plant before eventual transfer of the waste back to the LERF.

Waste transfers between the tank trailers and the 1706-KE Building will be intermittent, depending on the laboratory schedule for the waste water pilot plant. Also, the transfer rate will be relatively low, i.e., approximately 5 gallons (19 liters) per minute. The intermittent nature of the unloading and loading activities at the 1706-KE Building essentially will establish the tank trailers as short-term storage tanks, periodically located outside the 1706-KE Building. Because the tank trailer is single walled, provisions will be made for tank trailer secondary containment and surveillance as required by WAC 173-303-630(7).

4.3.3.3.1 Waste Unloading at the 1706-KE Building Load/Unload Station. The waste water will be transferred from the tank trailer to the waste water pilot plant in the 1706-KE Building using a pump located adjacent to the load/unload station (Figure 4-24). The self-priming, low-capacity pump will be positioned over a small catch tank. The pump will be used to feed the waste water to the pilot plant process equipment. Pump on and off switches will be located at the central control panel in the 1706-KE Building and at the load/unload station.

The tank trailer will be connected to the 1706-KE Building using a combination of flex hose and all-welded pipelines. The tank trailer load-in/load-out port will be connected to a flex hose using a quick-connect fitting. The flex hose will be connected to the transfer pump using an all-welded pipeline. The all-welded pipeline from the flex hose to the pump will be suspended from the piping support structure. The pump will be connected to the 1706-KE Building using an aboveground, all-welded pipeline. The pipeline will be suspended from a piping support structure over the roadway.

Tank trailer air emissions during unloading will be controlled using the existing carbon adsorbers and HEPA filters of the 1706-KE Building ventilation system. The existing ventilation system will be connected to the load/unload station by using a tee in the ventilation line to the 3,000 gallon (11,356 liter) storage tanks located at the west side of the 1706-KE Building. A pipeline will be run from the tee in the storage tank ventilation line to the end of the load/unload station piping support structure. From the piping support structure, the ventilation line will continue to the tank trailers using flex hoses. The final connection from the flex hoses to the trailer vent ports will be accomplished using a valved quick-connects at the terminal end of the flex hoses.

As at the LERF, bottled nitrogen gas will be supplied for tank trailer liquid-level indication (Figure 4-24). The supply line is hard piped out to the end of the piping support structure. From the piping support structure, flex lines with quick disconnects will provide the connection to the bubble-pipe (liquid-level detector) ports on the tank trailers. Liquid-level indication and alarm will be provided at the control panel inside the 1706-KE Building.

4.3.3.3.2 Waste Loading at the 1706-KE Building Load/Unload Station. Waste from the waste water pilot plant will be transferred in tank trailers to the LERF for storage. The tank trailers will be filled at the load/unload station located northwest of the 1706-KE Building (Figure 4-23 and 4-25). Loading of the treated waste will be accomplished using the waste water pilot plant process pumps. An all-welded pipe will carry the waste discharge from the process pumps through the 1706-KE Building wall to the load/unload station piping support structure. A flex hose will join the all-welded pipe to the tank trailer. The terminal end of the flex hose will be provided with a quick-connect coupling to the tank trailer load-in/load-out port.

The tank trailer air emissions controls and liquid-level detection will be configured in the same manner as described for the unload system (Section 4.3.3.3.1).

4.3.3.3.3 Containment and Surveillance at the 1706-KE Building Load/Unload Station. The all-welded waste piping between the tank trailers at the load/unload station and the 1706-KE Building is single-encased, aboveground construction and does not require secondary containment per WAC 173-303-640. Secondary containment will be provided for the unload pump connections by a catch tank with a leak detector (Figure 4-24). Secondary containment will be provided for the tank trailers, flex hoses, and connectors by a portable berm (Figures 4-24 and 4-25). The single-encased piping and portable berm will be inspected at least every 24 hours.

The catch tank will be mounted on the unload pump platform that will be located at the 1706-KE waste load/unload station. The purpose of the catch tank is to provide secondary containment for the waste unload pump and its associated threaded/screwed pipe fittings. The unload pump will be mounted on a grating supported by the platform. The grating will be 9 feet (2.7 meters) above the ground. The catch tank will be located directly below this grating. The platform grating and catch tank will be supported by four 4-inch by 4-inch by 0.5-inch (10-centimeter by 10-centimeter by 1.3-centimeter) angle iron uprights anchored in concrete pilings that will be 18 inches (48 centimeters) in diameter and 3 feet (0.9 meters) deep. The pump will be elevated above the tank trailer to eliminate the potential for inadvertently siphoning waste from the tank trailer.

The tank will be 3 feet 4-5/8 inches (1 meter) wide x 1 foot 6 inches (0.5 meter) high x 5 foot 3 inches (1.6 meters) long. The tank will be constructed of ASTM A36 carbon steel plate that is 1/8 inch (3 millimeters) thick. The capacity of the tank will be 199 gallons (753 liters). There will be a 1-inch (2.5-centimeter) diameter drain hole located in the bottom of the tank. A 1-inch (2.5 centimeter-) half-coupling welded to the bottom of the hole will provide for the attachment of a lockable drain valve.

A leak detector will be installed in the unload pump catch tank (Figure 4-24), and will be interlocked to shutdown the unload pump and to alarm at the central control panel in the 1706-KE Building. The liquid-level indicator for the tank trailer being loaded will be interlocked to shutdown the waste water pilot plant process pumps at high level.

The catch tank capacity of 199 gallons (750 liters) is more than adequate to contain the 11 gallons (42 liters) of liquid that would collect in the catch tank before the leak detector would actuate the interlock to shutdown the transfer pump and the 5.5 gallons (21 liters) of waste contained in the pump suction and in the 122 feet (37 meters) of 1-inch (2.5-centimeter) transfer pipe draining to the catch tank plus the 16.5 gallons (62 liters) of precipatation in the 25-year, 24-hour storm event. The 25-year, 24-hour storm event is calculated to deliver 1.5 inches (3.8 centimeters) of rain. Precipitation data were obtained from the U.S. Weather Bureau *Rainfall Frequency Atlas of the United States* (U.S. Weather Bureau 1961, p. 101).

Secondary containment will be provided for the tank trailers, waste water load/unload flex hoses, and connectors through the use of a portable berm. The secondary containment structure selected for use is a portable berm. The portable berm is discussed in detail in Section 4.3.3.4. A double-wide portable berm will be used at the 1706-KE Building load/unload station. The portable berm will have inside dimensions of 23 feet (8.8 meters) wide by 49 feet 3 inches (15 meters) long by 2 feet (0.6 meter) deep. The berm is sized to contain two tank trailers side by side.

The portable berm unit at the 1706-KE Building will have a capacity of 15,000 gallons (56,780 liters). The berm will have the capacity to contain the full contents of the two 5,000 gallon (18,900 liter) tank trailers plus more than sufficient capacity to contain the 1,060 gallons (4,013 liters) that could result from a 25-year, 24-hour storm as required by WAC 173-303-630(7).

Because of the lengthy loading and unloading times (up to 4 months) at the 1706-KE Building, it will be desirable that the tractors be disconnected from the tank trailers during the loading and unloading processes. The berm will have gates at both ends to allow the trailers to pull through.

4.3.3.4 Portable Berms. The secondary containment structure selected for use at both the LERF and 1706-KE waste load/unload stations is the SpilGard portable berm manufactured by ModuTank Incorporated. The portable berm will provide secondary containment for the tank trailer and flex hose connectors. The portable berm, an engineered modular containment system, will be assembled onsite. The walls of the portable berm will consist of steel panels. The walls will be held in position by exterior steel frames and interior steel cables. A geomembrane will be draped over the top of the steel walls and will be fastened to the walls with extruded plastic clips. The geomembrane will provide for liquid containment and will be supported by the steel wall panels and an engineered foundation. All seaming of the geomembrane will be performed in the factory before shipment to the Hanford Facility. The vendor information on the design and assembly of the portable berm is included in Appendix 4E.

The portable berm will be placed on an engineered foundation consisting of a 0.35-foot (11-centimeter) thick asphalt concrete pad placed over a base of 0.3-feet (9-centimeter) thick crushed gravel and compacted site soil. Calculations are included in Appendix 4F showing that the engineered foundation will be adequate to prevent undue geomembrane stress due to foundation settlement caused by a loaded tank trailer. The foundation will be sloped to allow liquids to be collected and removed.

Movable steel gate panels will allow for ingress and egress from the bermed area. To open the gate, the geomembrane liner will be pulled back off the gate area, the gate opened, and the liner laid flat. The flattened liner will be protected by laying a neoprene coated polyester mat over the liner at the ingress/egress location.

The liner of the portable berm will consist of an 8130 XR-5[a] geomembrane. The geomembrane will be an 'ethylene interpolymer alloy' (polyvinyl chloride) coated polyester fabric. The fabric will be 30 mils thick. The geomembrane coating will be modified with Elvaloy[b]. The Elvaloy modifier will make the geomembrane more flexible and more chemically resistant. Before the containment system is put into service, the thickness and weight of the geomembrane material will be verified using test methods specified in ASTM D 751 (ASTM 1989).

The general chemical resistance and material strength characteristics of the geomembrane material are presented in the vendor information (Appendix 4E). General information on the weather (ultraviolet radiation) resistance and chemical resistance of the geomembrane also is presented in Appendix 4E. A piece of the geomembrane material (coupon) will be exposed as part of the containment structure to assess the geomembrane for deterioration. The coupon will be from the same batch as the geomembrane material and will include a seamed area. The coupon will be tested for deterioration per method ASTM D 751 (ASTM 1989) either when a spill has occurred or at least yearly.

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[a]8130 XR-5 is a trademark of the Seaman Corporation.

[b]Elvaloy is a trademark of the E.I. DuPont de Nemours & Company.

To protect the geomembrane, a 100-mil nonwoven geotextile fabric, as provided by ModuTank, will be placed under and on top of the geomembrane material. As a further precaution, the upper geotextile layer will be covered with a 5/16-inch (0.8-centimeter) thick neoprene coated polyester fabric to protect the geomembrane liquid containment liner from any potential damage, and to aid in cleaning and maintenance.

To demonstrate the acceptability of the portable berm liner system for use at the waste water pilot plant, several liner failure scenarios were examined. The following mechanisms have been postulated for potential berm failure:

- Shear and seam
- Puncture
- Impact
- Compression
- Foundation settlement.

An engineering analysis for each of these potential failure mechanisms is presented in Appendix 4F. The results of these analyses and recommended berm failure preventive measures are described as follows.

- **Shear and Seam Failure**--The most likely scenario for shear failure is during tractor acceleration from a standing start while pulling a loaded tank trailer. Shear also is the failure mode for seam failure. The limiting case is seam failure with a shear strength of 52.5 pounds per square inch (362.0 kilopascals) for a seam verses 500 pounds per square inch (3,448 kilopascals) shear strength for the fabric. The load/unload procedure administratively will restrict tractor acceleration to less than 1 mile (1.6 kilometers) per hour per second. This will provide a safety factor of 2 over the seamed and 20 over the unseamed geomembrane. No credit is taken for the significant load distribution provided by the geotextile and neoprene rubber mat overlays.

- **Puncture**--The greatest risk of puncture to the geomembrane is considered to be due to the presence of sharp rocks or other foreign objects lying under the loaded trailer tire either directly above or directly below the geomembrane. Rocks embedded in the tires are also a source of potential puncture. Any foreign objects will be cleared from the geomembrane foundation and upper surface during installation. Any rocks embedded in the tractor or trailer tires will be removed before vehicle entry into the berm. The engineering analysis indicates that the absence of rocks with a diameter of 0.5 inch (1.3 centimeter) or greater will provide a factor of safety of at least 15. No credit is taken for the load distribution properties of the geotextile and neoprene rubber mat.

- **Impact**--Impact failure most likely would be caused by the accidental dropping of a heavy tool with a pointed end, such as a crow bar or electric drill. The engineering analysis indicates that a 5 pound (2.2 kilogram) crow bar with a 1-inch (2.5-centimeter) wide chisel end dropped from a height of 4 feet (1.2 meters) could cause impact failure of the unprotected geomembrane. Administrative procedures will require that no tools weighing more that 1 pound (0.4 kilogram) be allowed in the berm without a waiver (and training) from the Engineering and Environmental Development Laboratory manager. Maintenance personnel also will be counseled before performance of any repair activities over the berm. No credit is taken for the neoprene rubber mat that will cover most of the bermed area.

- **Compression**--The tank trailer tires will exert a compressive load of 125 pounds per square inch (862 kilopascals) on the berm floor. The geomembrane can withstand a hydrostatic pressure of 500 pounds per square inch (3,448 kilopascals). This provides a safety factor of 4 against the possibility of failure in compression. No credit is taken for the significant load distribution properties of the geotextile and neoprene rubber mat overlays.

- **Settlement**--Settlement of the berm foundation could stress the geomembrane in tensile. The amount of settlement induced deflection the liner can withstand is 0.64 inch (1.6 centimeters), assuming a safety factor of 2. To preclude potential damage due to this mechanism, an engineered foundation will be provided for the berms. Using this foundation, settlement due to subsidence is anticipated to be less than 0.013 inch (0.03 centimeter) under a dynamic load.

Truck speed into or out of the bermed area will not exceed 5 miles (8 kilometers) per hour. To further protect the liner, the tank trailer spotting procedure will caution the driver to avoid 'locking' the truck and trailer wheels on the liner material. Because of the space limitations within the berms, positioning the tank trailer will be performed as a low-speed operation.

4.3.4 Critical Parameters and Safety Features

Certain waste transfer system design features and operating procedure requirements are critical to operator safety and protection of the environment. These parameters and safety features are provided in the following sections.

4.3.4.1 Design Features. Waste transfer design features are as follows:

- Tank trailer has a factory-installed ASME pressure relief rupture disk - rated at 52 $\pm$5 pounds per square inch (359 $\pm$34 kilopascals).

- Tank trailer has a Hanford Site-installed vacuum relief device - rated at 0.5 to 5 inches (1.3 to 12.7 centimeter) of mercury.

- Tank trailer gaseous discharges are tied into the 1706-KE Building or the LERF ventilation system.

- 1706-KE Building tank trailer loading pumps are interlocked to the tank trailer liquid-level instrumentation.

- 1706-KE Building unload station discharge pump is interlocked to the pump catch basin leak detector and the 1706-KE Building receiving tank liquid-level instrumentation.

- All alarm switches activate visible and audible alarms at the central control panel, as well as the appropriate interlocks.

4.3.4.2 Operating Parameters. Waste transfer operating parameters are as follows.

- Ventilation line valve is open during loading and unloading. Heat tracing to prevent freezing is functional when ambient temperatures are below 40 °F (4.4 °C).

- Pumpout line valve alignment sequence is verified correct before pumping is initiated.

- Tank trailer and liquid-level instrumentation is under continuous manned surveillance during loading and unloading at the LERF.

- Reviewed and approved operating procedures are used for loading and unloading.

- Protection of the area where the tank trailer is loaded and unloaded is accomplished by the use of a portable berm during the loading and unloading operations at the LERF and the 1706-KE Building.

- Surveillance, at least once every 24 hours, is performed of the load/unload station at the 1706-KE Building.

- Verification is performed that the waste water is ≤low-specific activity before shipment (Section 3.0).

- Verification is performed that waste water characteristics fall within the operating envelope before waste is unloaded at the 1706-KE Building.

4.4 EQUIPMENT DECONTAMINATION

When decontamination of equipment is required (e.g., for leaks or spills), decontamination will consist of rinsing equipment that has been contacted by a listed dangerous waste. A guideline decontamination procedure has been developed that meets the triple-rinsing criteria for vessels that previously held dangerous waste. The waste water pilot plant equipment also could be decontaminated at any time using this procedure during a testing program. The decontamination procedure is included in Appendix 4G.

Contaminated equipment or other secondary waste not returned to the LERF, which is destined for treatment and/or disposal will be placed in U.S. Department of Transportation-compliant containers. The containers will be labeled as necessary and will be managed in compliance with 40 CFR 262.34(c)(1) in a satellite accumulation area. When the waste container is filled, the waste generation date will be marked on the container and the waste will be moved to a RCRA-compliant less-than-90-day storage area and the waste will be managed in accordance with all 40 CFR 262.34 conditions. The waste will be designated. Upon designation of the containerized waste, additional labeling will be placed on the container as necessary and the waste will be transferred to a Hanford Facility TSD unit in accordance with onsite procedures.

Contaminated equipment that is destined for reuse will be stored in an area equipped with secondary containment.

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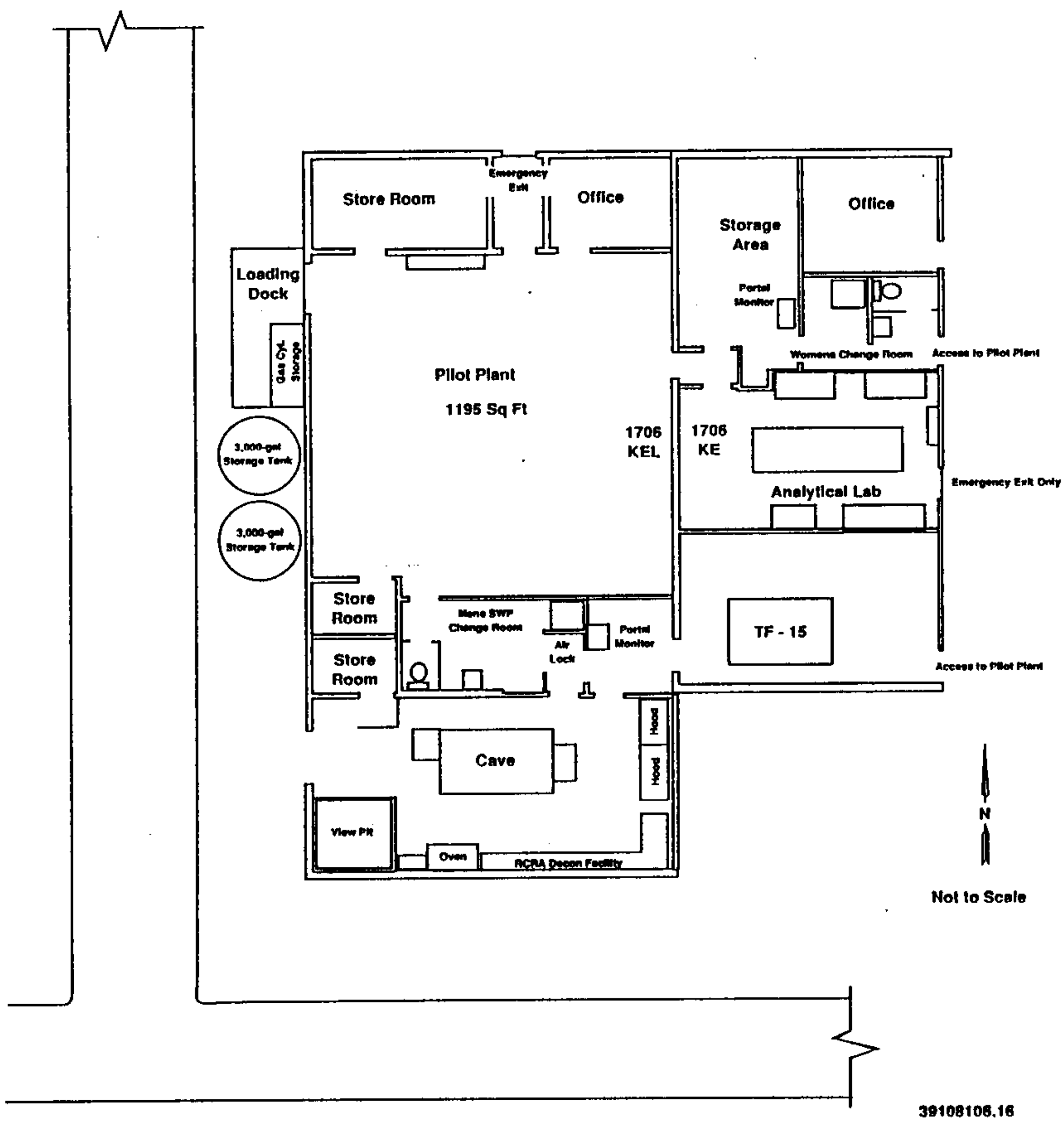

Figure 4-1. Waste Water Pilot Plant Floor Plan.

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WASTE WATER PILOT PLANT

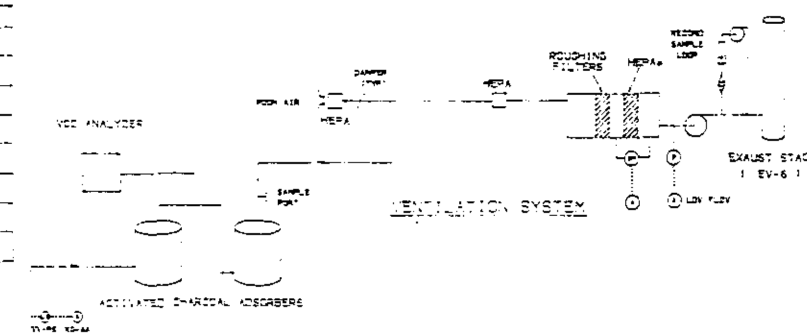
STREAM CHARACTERISTICS

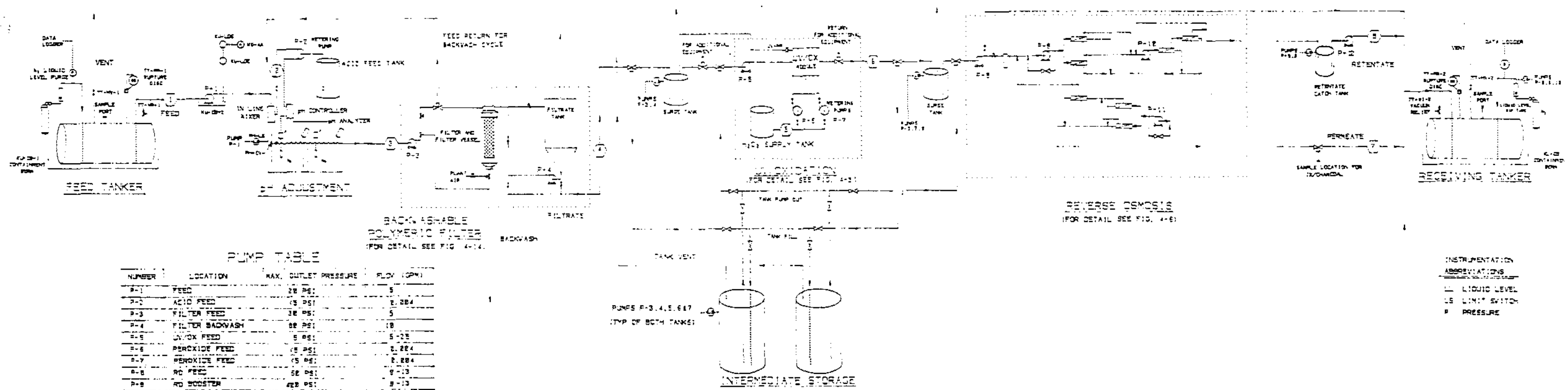
LOCATION	(1) FEED	(2) ACID FEED	(3) pH OUT	(4) FILTRATE	(5) PEROXIDE FEED	(6) UV/OX OUT	(7) RO PERMEATE	(8) RO RETENTATE
FLOW (GPM)	5	0.004	5	5	0.004	5-25	4.5	0.5
TEMP (F)	AMBIENT	50 - 70	50 - 70	50 - 70	50 - 70	50 - 80	60 - 70	60 - 70
pH	7 - 11	-	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5
VOC (PPM)	<1.0	-	<1.0	<1.0	-	<1.0	<1.0	<1.0
OTHER	-	95% H2SO4	-	-	50% H2O2	-	-	-

NOTE: DOTTED LINES AROUND UNIT OPERATIONS DENOTE THE BOUNDARIES OF THE REFERENCED FIGURES

TANK TABLE

TANK	QUANTITY	CAPACITY (GALLONS)
FEED TANKER	1	5,000
H2SO4 ACID FEED	1	30
FILTRATE STORAGE	1	100
UV/OX FEED SURGE	1	200
H2O2 SUPPLY	1	55
RO FEED SURGE	1	100
RETENTATE CATCH	1	55
INTERMEDIATE STORAGE	2	3,000
RECEIVING TANKER	1	5,000





PUMP TABLE

NUMBER	LOCATION	MAX. OUTLET PRESSURE	FLOW (GPM)
P-1	FEED	20 PSI	5
P-2	ACID FEED	<5 PSI	0.004
P-3	FILTER FEED	30 PSI	5
P-4	FILTER BACKWASH	80 PSI	10
P-5	UV/OX FEED	5 PSI	5-25
P-6	PEROXIDE FEED	<5 PSI	0.004
P-7	PEROXIDE FEED	<5 PSI	0.004
P-8	RO FEED	50 PSI	9-13
P-9	RO BOOSTER	400 PSI	9-13
P-10	RO BOOSTER	500 PSI	5-12
P-11	RO BOOSTER	600 PSI	9-13
P-12	RETENTATE	10 PSI	1-2

Figure 4-2. Waste Water Pilot Plant
Process Flow Diagram

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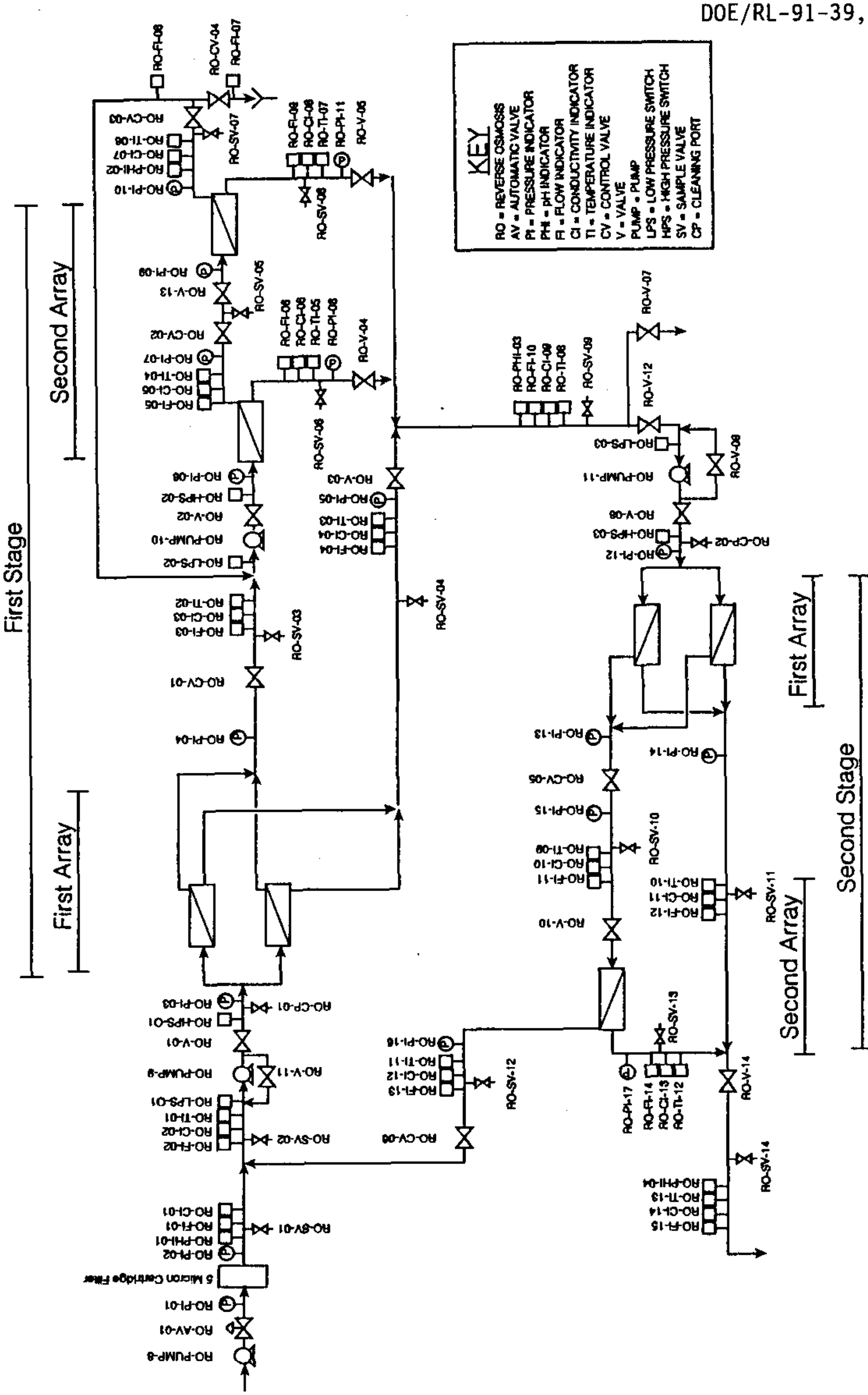

Figure 4-6. Reverse Osmosis Piping and Instrumentation Drawing

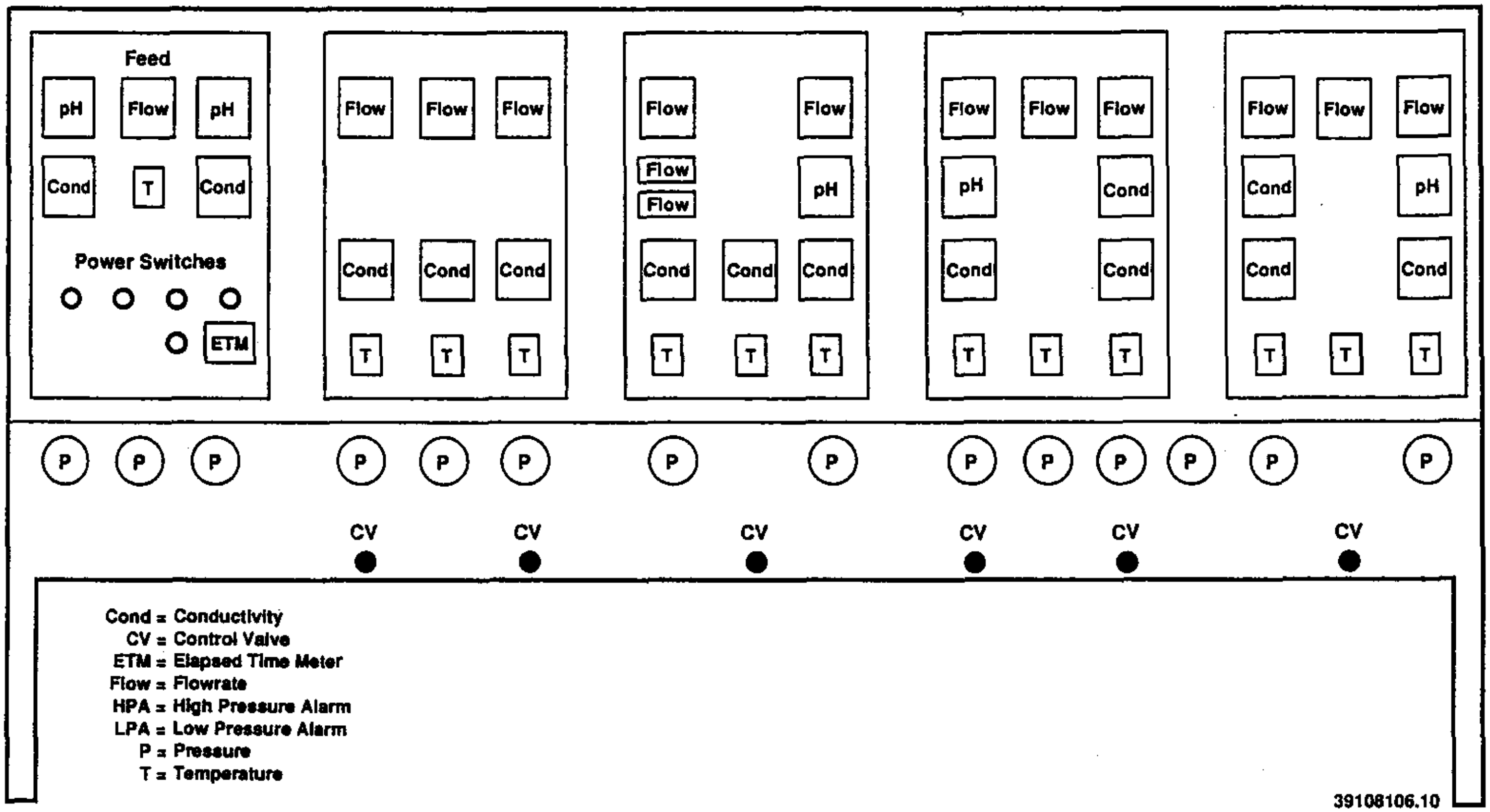

Figure 4-7. Reverse Osmosis Panel Board.

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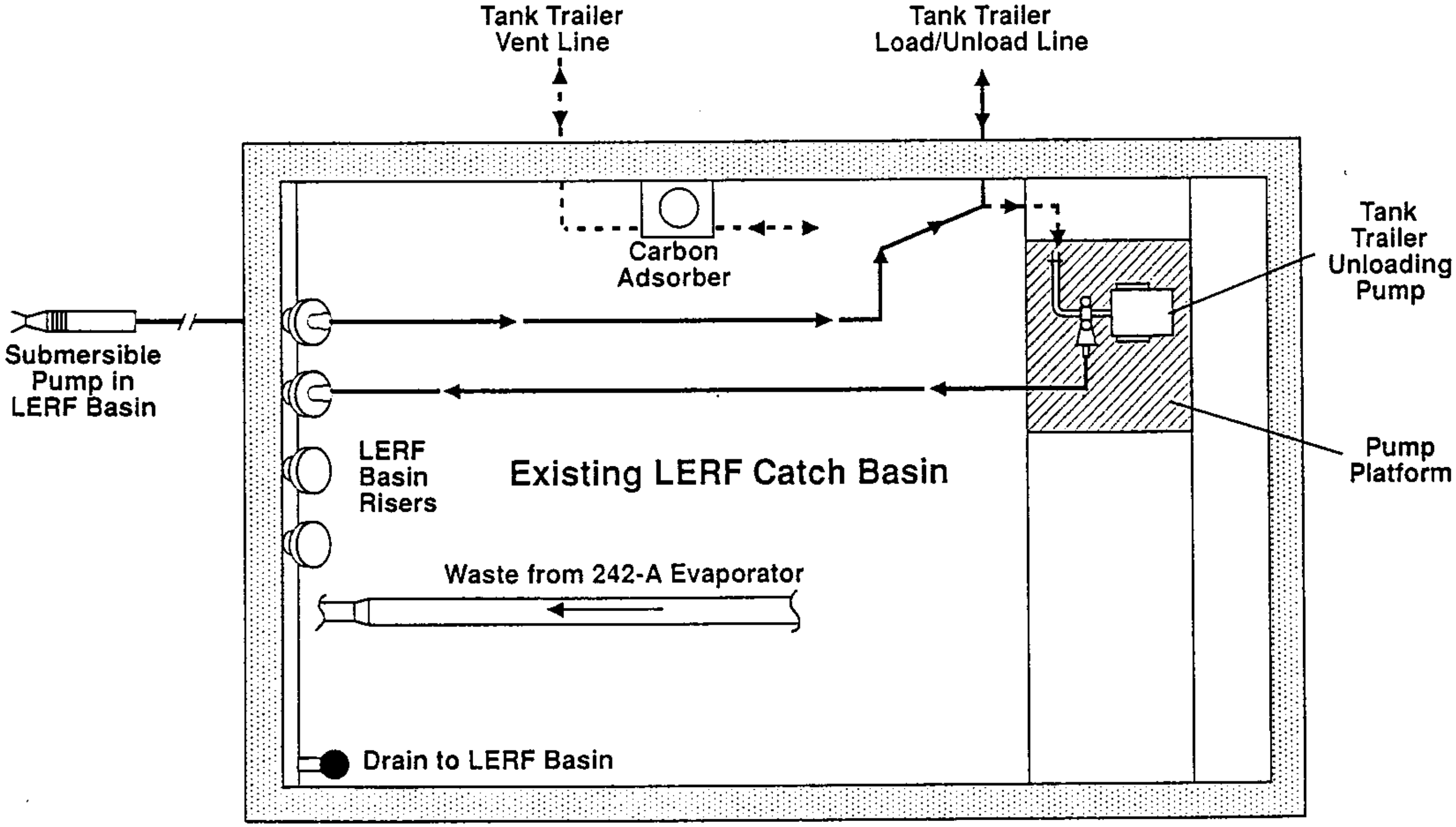

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Figure 4-20. The Liquid Effluent Retention Facility Catch Basin Piping Configuration

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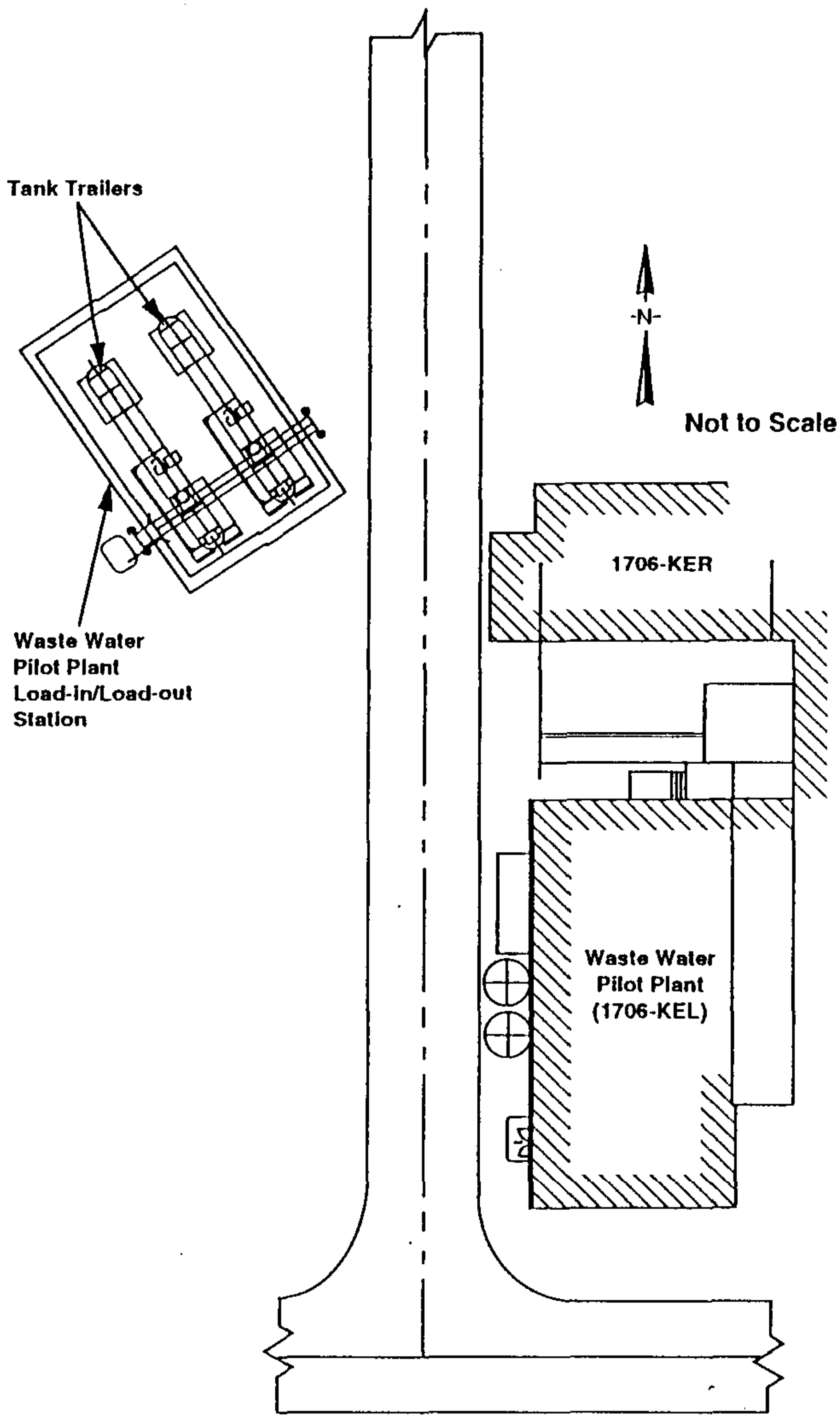

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Figure 4-23. Waste Load/Unload Station at the 1706-KE Building.

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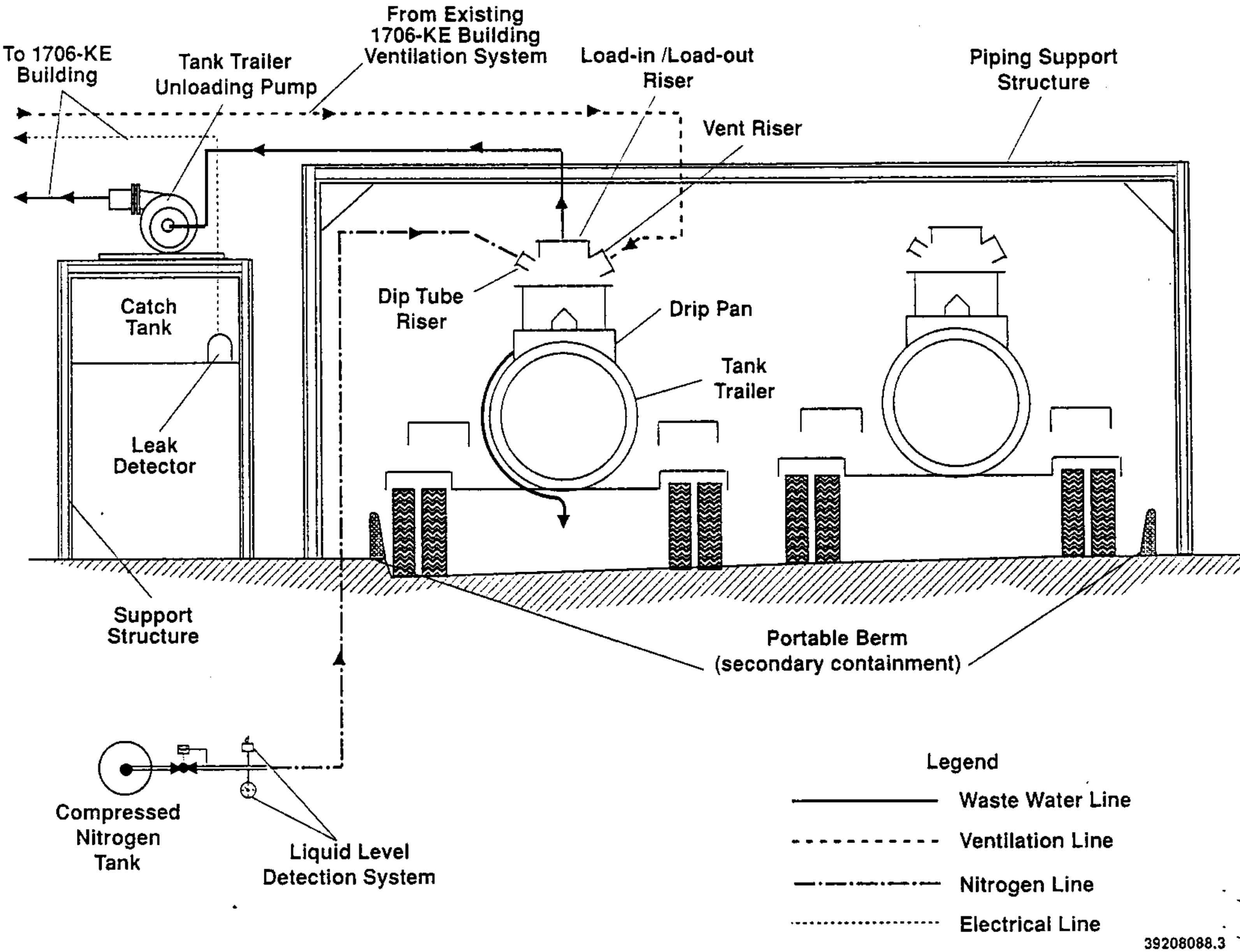

Figure 4-24. Tank Trailer Configuration for Unloading at the 1706-KE Building.

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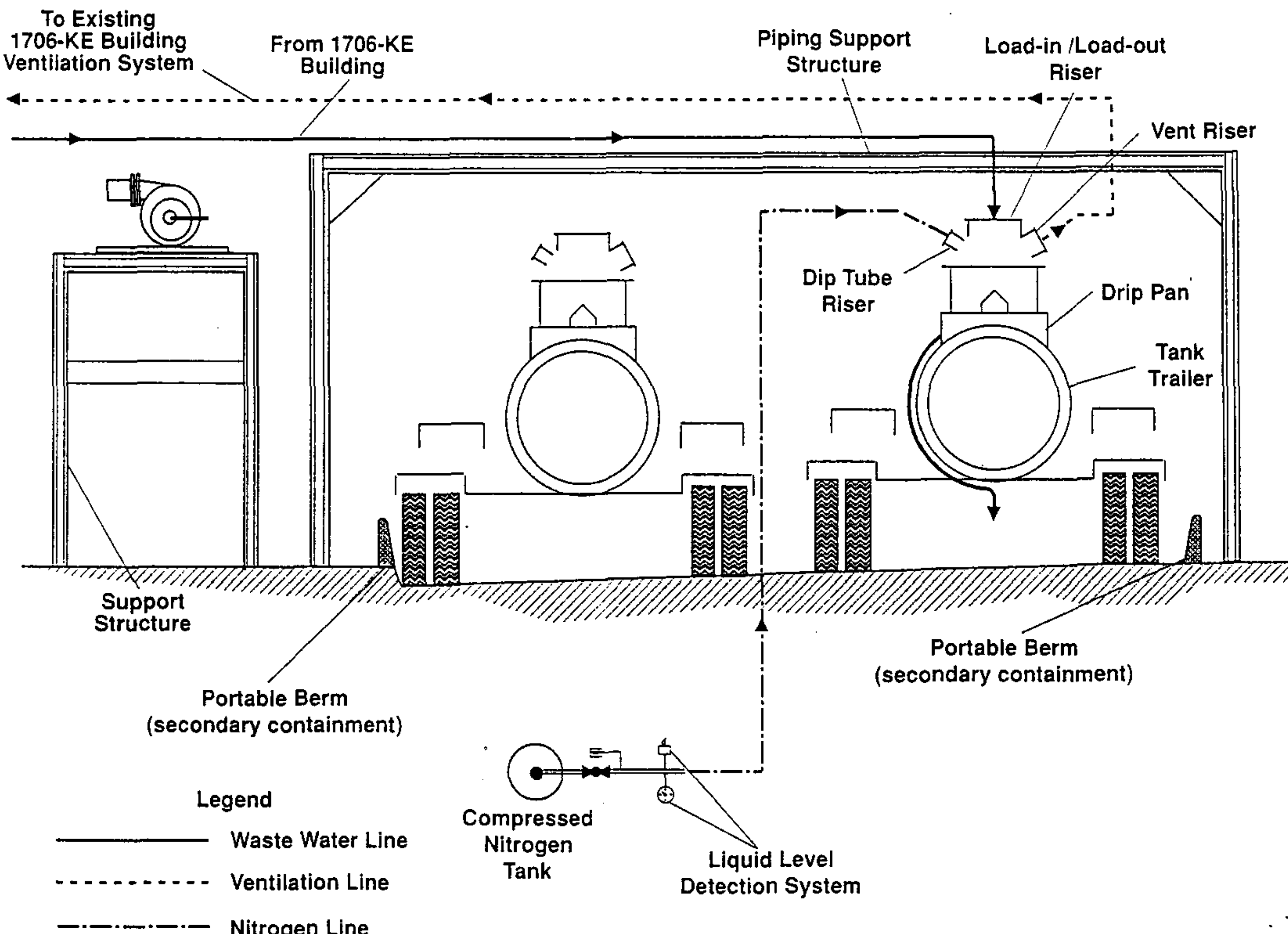
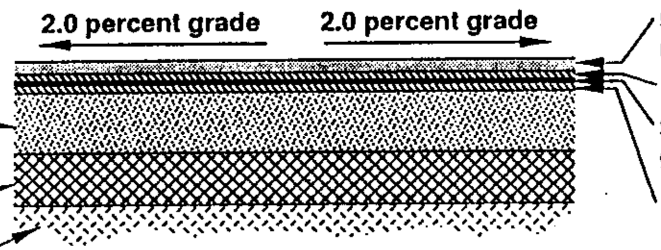


Figure 4-25. Tank Trailer Configuration for Loading at the 1706-KE Building.



Notes:

1. Prepare the subgrade per Washington State Department of Transportation (WSDOT) (ref. 1) Section 2-06.3(1).
2. Crushed surfacing will conform to WSDOT (ref. 1) Section 9-03.9.3 base course. Place and compact in accordance with Section 4-04.3(4) and 4-04.3(5).
3. The asphalt concrete pavement will be spread and finished in accordance with WSDOT (ref. 1) Sections 5-04.3(9) and 5-04.3(10).
4. Crushed surfacing and asphalt concrete pavement thicknesses meet the minimum required thicknesses for truck parking per reference 2.

References:

1. WSDOT 1991, "Standards and Specifications for Road Bridge and Municipal Construction", M41-10.
2. WSDOT 1988, "Design Manual", M22-01, June 1988. Appendix 1, Figure 326-3, p. 16.

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Figure 4-26. Cross-Section of the Portable Berm Components and the Berm Foundation.

Table 4-3. Predicted Effectiveness of Ventilation System Activated Carbon with Spiked Liquid Effluent Retention Facility Feed. (sheet 1 of 2)

Volatile organic compound	Maximum feed concentration (ppm)(a)	Maximum pounds per batch (b)	Charcoal retentivity	Maximum charcoal required per batch (b)(c)
Acetone	101.0	0.842	15	5.61
1-Butanol	200.0	1.667	36	4.63
2-Butanone (MEK)	2.2	0.018	26	0.07
Butraldehyde (butanal)	2.3	0.019	21	0.09
Chloroform (trichloromethane)	0.8	0.007	32	0.02
Ethyl alcohol (ethanol)	0.01	0.000	21	0.00
Methylene chloride (dichloromethane)	3.8	0.032	25	0.13
Methyl n-propyl ketone (2-pentanone)	0.2	0.002	26	0.01
Methyl n-butyl ketone (2-hexanone)	0.8	0.007	22	0.03
Methyl isobutyl ketone (hexone)	1.7	0.014	30	0.05
2-Propanol (isopropyl alcohol)	0.2	0.002	26	0.01
Tetrahydrofuran	1.7	0.014	21	0.07
1,1,1-Trichloroethane	1.0	0.008	35	0.02
Acetonitrile	2.0	0.017	2	0.83
Carbon disulfide	10.0	0.083	15	0.56
Carbon tetrachloride	0.5	0.004	45	0.01
Sodium cyanide	0.2	0.002	1(d)	0.17
m-Dichlorobenzene	1.0	0.008	52	0.02
Dichloroisopropyl ether	1.0	0.008	13	0.06
Ethylene glycol monomethyl ether	1.0	0.008	31	0.03

Table 4-3. Predicted Effectiveness of Ventilation System Activated Carbon with Spiked Liquid Effluent Retention Facility Feed. (sheet 2 of 2)

Volatile organic compound	Maximum feed concentration (ppm)(a)	Maximum pounds per batch (b)	Charcoal retentivity	Maximum charcoal required per batch (b)(c)
Ethyl methacrylate	2.0	0.017	23	0.07
Formic acid	10.0	0.083	7	1.19
Methyl butyl ether	1.0	0.008	22	0.04
Phenol	2.1	0.018	30	0.06
Pyridine	10.5	0.088	25	0.35
Toluene	1.0	0.008	29	0.03
Trichloroethylene	0.5	0.004	30	0.01
Totals	358.5	2.989		14.16

(a) 90% C.I. feed concentration plus maximum spike concentration.
(b) Batch size assumed to be 1,000 gallons, refer to Section 4.1.3.2.
(c) Calculations assume 100% volatilization of the volatile organics.
(d) No retentivity data, assumed lowest value (compound has very low volatility).

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Table 4-4. Control of Critical Parameters.
(sheet 3 of 6)

Equipment location	Control parameter	Hazard	Control method(s)	Control device	Control setpoint	Alarm setpoint and response	Instrument Range	Expected Range	Accuracy
UV-vsl uv/ox reactor vessel	high pressure	vessel rupture followed by possible personnel injury and building or equipment contamination	bourdon tube type pressure indicator UV-pi-1	procedural control	15 psig	operator shuts down feed pump	0-30 psig	0-10 psig	±0.5 psig
UV-vsl uv/ox reactor vessel	high temperature	thermal stress on quartz sheaths and uv lamps resulting in breach of containment followed by personnel injury and building or equipment contamination	vendor installed temperature switch, alarm, and electrical interlock temperature indicator	temperature switches UV-TK-1,-2 for enclosure temperature and water temperature operator inspection	150 °F 150 °F	actuates visible alarm on module control panel and shuts down feed pump P-5 operator manually shuts down reactor	NA 0-200 °F	80-130 80-130	±5 °F ±5 °F
UV-vsl uv/ox reactor vessel	ultraviolet light	personnel exposure to intense uv light	uv filtration	uv filters on view ports	NA	NA	NA	NA	NA
UV-vsl uv/ox reactor vessel	ultraviolet light	personnel exposure to intense uv light	door closure	door closure limit switch UV-ls-1	NA	open door deactivates electric power to lamps	NA	NA	NA
LF filtration module at LERF	high pressure	equipment rupture followed by possible personnel injury and equipment contamination	pressure switch shuts down feed pump	pressure switches LF-pi-1 LF-pi-2 LF-pi-3 LF-pi-6 LF-pi-7	150 psig	≥150 psig activates visible alarm and shuts down associated feed pumps	0-150 psig	0-130 psig	±5 psig

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03/19/93

Table 4-4. Control of Critical Parameters.
(sheet 4 of 6)

Equipment location	Control parameter	Hazard	Control method(s)	Control device	Control setpoint	Alarm setpoint and response	Instrument Range	Expected Range	Accuracy
KF filtration at 1706-KE	high pressure	equipment rupture followed by possible personnel injury and equipment contamination	pressure relief	pressure relief valves	<150 psig	NA	0-150 psig	0-130 psig	±5 psig
RO reverse osmosis module	high pressure	equipment rupture followed by personnel injury and equipment or building contamination	vendor installed pressure switch shuts down feed pumps	pressure switch RO-hps-1,-2, -3 interlocked to feed pumps	600 psig	600 psig activates visible alarms, audible alarm KG-aa, and shuts down feed pumps P-8, P-9, and P-10	NA	0-550	±10 psig
RO reverse osmosis module	high pressure	equipment rupture followed by personnel injury and equipment or building contamination	procedural control	operator monitors system pressure indicators RO-pi-3, -6, and -12	600 psig	at pressure ≥600 psig operator shuts down feed pumps	0-1000	0-550	±25
PH-tk-1 pH adjustment tank	liquid level	waste water overflow resulting in equipment contamination	liquid level control	liquid level control loop consisting of conductivity type limit switch PH-ls and feed float control valve PH-cv	liquid level corresponding to 90% of tank volume	liquid level corresponding to 90% of tank volume activates high level visible alarm PH-lah, audible alarm KG-aa, and shuts down feed pump KU-pmp	NA	NA (tank levels described in Section 4.1.5.1)	±0.1 inch

Table 4-4. Control of Critical Parameters.
(sheet 5 of 6)

Equipment location	Control parameter	Hazard	Control method(s)	Control device	Control setpoint	Alarm setpoint and response	Instrument Range	Expected Range	Accuracy
PH-tk-1 pH adjustment tank; LERF pH adjustment tank)	outlet pH	corrosion if pH is too low, ammonia volatility and pH too high	pH controller for addition of sulfuric acid	pH analyzer on second chamber of pH adjustment vessels	4 to 7	alarm	1 to 13	5.0 to 6.5	±0.2
PH-tk-1 pH adjustment tank; LERF pH adjustment tank)	outlet pH	corrosion if pH is too low, ammonia volatility and pH too high	pH controller for addition of sulfuric acid	pH analyzer on second chamber of pH adjustment vessels	3 to 8	process shut down	1 to 13	5.0 to 6.5	±0.2
PH-tk-2 sulfuric acid feed tank for pH adjustment	corrosion	loss of containment resulting in personnel injury and equipment or building contamination	procedural: proper design (including material selection), construction, and maintenance	review of engineering design and construction media, operations and maintenance procedures; leak test before use	NA	NA	NA	NA	NA
PH-vsl sulfuric acid feed tank for pH adjustment and UV-tk-2 hydrogen peroxide feed tank for uv/ox reactor	corrosive chemical	chemical burns to skin or eyes	procedural control of the chemical handling	personnel protective gear including eye wash station, protective eye wear, rubber gloves	NA	immediately flush affected tissue with copious amount of water, then contact first aid	NA	NA	NA
VV-hepa 1706-KE vessel vent HEPA filtration system	high differential pressure (dp)	HEPA filter rupture followed by contamination release to the outside atmosphere	daily inspection controlled by procedure	VV-dpc diaphragm type differential pressure gage	≥3.5 inch water	replace filters	0 to 6.0 inch of water	0.5 to 3.0 inch of water	2% of full scale

Table 4-4. Control of Critical Parameters.
(sheet 6 of 6)

Equipment location	Control parameter	Hazard	Control method(s)	Control device	Control setpoint	Alarm setpoint and response	Instrument Range	Expected Range	Accuracy
VV-hepa 1706-KE vessel vent HEPA filtration system	low differen-tial pressure (dp)	indicates filter rupture followed by contamination release to the outside atmosphere	daily inspection controlled by procedure	VV-dpc diaphragm type differential pressure gage	<0.3 inch water	replace filters	0 to 6.0 inch of water	0.5 to 3.0 inch of water	2% of full scale
VV 1706-KE vessel vent system	low vacuum	vapor release to lab atmosphere	vessel vent continuous vacuum measurement	vacuum switch VV-ps activates alarm	<0.5 inch water	actuates visible alarm VV-pal and audible alarm KG-aa; troubleshoot	0.3 to 1.0 inch fo water	0.5 to 1.0 inch of water	2% of full scale
All process equipment	containment	loss of containment due to leakage of equipment	double containment	spill pan with ≥110% of tank capacity, walls ≥3 inches, footprint ≥1 foot beyond equipment	NA	NA	NA	NA	NA
All process equipment	containment	loss of containment due to leakage of equipment	procedural control	operator inspection required by procedure	no visible liquid in spill pan	shut down, troubleshoot and repair/ replace failed item	NA	NA	NA

- Solid waste
  - Nondangerous and nonradioactive
  - Nondangerous and radioactive
  - Dangerous and nonradioactive
  - Dangerous and radioactive.

Depending on the classification of the waste, disposal of the waste could include additional decontamination at an onsite treatment unit. The exact identification of the treatment or disposal unit cannot be provided at this time as the treatment or disposal depends on the type of contamination encountered. Some disposal trenches that might be suitable to receive contaminated equipment are located within the Hanford Facility.

When removed from the waste water pilot plant for disposal, all waste will be properly packaged in accordance with U.S. Department of Transportation regulations.

8.1.11 Closure Equipment Decontamination

The equipment used during the closure activities will be cleaned three times with a steam cleaner. The equipment cleaning will be performed over a solid sheet of durable plastic. The plastic will be of an appropriate thickness. The thickness will depend on the equipment and the amount of abrasion expected from cleaning activities. The sides of the plastic will be elevated to prevent the escape of rinsate. The rinsate from steam cleaning will be collected, pumped into new bung type 17-H U.S. Department of Transportation-55-gallon (208-liter) containers, and sampled. The pump will be flushed three times with water that will be managed as rinsate. The plastic liner will be removed and disposed of in a manner determined by contaminants found in the rinsate.

8.1.12 Closure of Containers

Containers will be used to collect and contain dangerous waste in the event of a spill, unexpected release, or an equipment failure. Any containers used to collect dangerous waste at the waste water pilot plant will be disposed of in the appropriate manner. Containers of dangerous waste will not be left in the waste water pilot plant after closure.

8.1.13 Closure of Tanks

Clean closure will consist of the removal and disposal of all dangerous waste and the decontamination, sampling, removal, and disposal of contaminated equipment, including the intermediate storage tanks. The intermediate storage tanks will be treated in the same manner as all other contaminated process equipment removed from the waste water pilot plant. This treatment is described in Sections 8.1.5 and 8.1.7.

8.1.14 Schedule for Closure

The waste water pilot plant is expected to operate for a period of 1 year. Depending on the progress of the test efforts, up to two additional 1-year operational periods could be requested. Any dangerous waste in the pilot plant will be removed within 90 days following the completion of the test program. All closure activities will be completed within 180 days following the completion of the test program.

8.1.15 Amendments to Closure Plan

Should changes be required to the approved closure plan, an amended plan will be prepared and submitted to the EPA and Ecology for approval in accordance with 40 CFR 264.112(c) and WAC 173-303-610(3)(a).

8.1.16 Certification of Closure and Survey Plat

Within 60 days of the final closure of the waste water pilot plant, the DOE-RL will submit a certification of closure to the EPA and Ecology in accordance with 40 CFR 264.115 and .116 and WAC 173-303-610. This certification will be signed by an authorized representative of the DOE-RL and by an independent registered professional engineer, and will state that the waste water pilot plant has been closed in accordance with the approved closure plan. The certification will be submitted by registered mail or an equivalent delivery service. The independent, registered professional engineer, who will be monitoring closure, will visit the site at least at the commencement and at the end of each activity described in the closure plan (e.g., inventory removal, contaminated equipment removal, 1706-KE Building decontamination). The professional engineer will review all records, notes, analyses, files, manifests, etc., relating to the closure activities. Documentation supporting the closure certification will be retained by the DOE-RL and provided to the EPA and Ecology upon request. This documentation will be kept by the DOE-RL contact (or its successor) identified in Section 8.3.

8.1.17 Owner/Operator Closure Certification

The DOE-RL will certify the closure of the waste water pilot plant with the following statement or a statement similar to it:

> "I, (name), an authorized representative of the U.S. Department of Energy Richland Field Office, located at the Federal Building, 825 Jadwin Avenue, Richland, Washington, hereby state and certify that the waste water pilot plant to the best of my knowledge and belief, has been closed in accordance with the attached approved closure plan, and that the closure was completed on (date). (Signature and date.)"

8.1.18 Professional Engineer Closure Certification

The DOE-RL will engage an independent registered professional engineer to certify that the waste water pilot plant has been closed in accordance with this approved closure plan. The DOE-RL will require the engineer to sign the following statement or a statement similar to it:

> "I, (name), an independent registered professional engineer in the state of (state name) hereby certify, to the best of my knowledge and belief, that I have made visual inspection(s) of the waste water pilot plant and that closure of the aforementioned facility has been performed in accordance with the attached approved closure plan. (Signature, date, state professional engineer license number, business address, and telephone number.)"

8.3 CLOSURE COST ESTIMATE [I-4]

In accordance with 40 CFR 264.140(c) and WAC 173-303-620(1)(c), this estimate is not required for federal facilities. The Hanford Facility is a federally owned facility for which the federal government is the operator and this estimate is therefore not applicable to the waste water pilot plant.

An annual report updating projections of anticipated closure and postclosure costs for the Hanford Facility TSD units having final status will be submitted in accordance with WAC 173-303-620(1)(c) to Ecology by October 31.

8.4 FINANCIAL ASSURANCE MECHANISM FOR CLOSURE [I-5]

In accordance with 40 CFR 264.140(c) and WAC 173-303-620(1)(c), this section is not required for federal facilities. The Hanford Facility is a federally owned facility for which the federal government is the operator and this section is therefore not applicable to the waste water pilot plant.

8.5 LIABILITY REQUIREMENTS [I-8]

In accordance with 40 CFR 264.140(c) and WAC 173-303-620(1)(c), this section is not required for federal facilities. The Hanford Facility is a federally owned facility for which the federal government is the operator and this section is therefore not applicable to the waste water pilot plant.

8.6 CLOSURE CONTACTS

The following office (or its successor) is the official contact for the waste water pilot plant:

Office of Environmental
Assurance, Permits and Policy
U.S. Department of Energy
Richland Field Office
P.O. Box 550
Richland, Washington 99352
(509) 376-5441.

9.0 CERTIFICATION

The following certification, required by WAC 173-303-810(13), for all applications and reports submitted to Ecology is hereby included:

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

John D. Wagoner — 3/22/93

Owner/Operator — Date
John D. Wagoner, Manager
U.S. Department of Energy
Richland Field Office

Thomas M. Anderson — 3/17/93

Co-operator — Date
Thomas M. Anderson, President
Westinghouse Hanford Company

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10.0 REFERENCES

10.1 DOCUMENTS

AASHTO, 1983, *Standard Specification for Highway Bridges*, AASHTO-HS 20-44 American Association of State Highway Transportation Officials, Washington, D.C.

ASME, 1989, *Boiler and Pressure Vessel code, ASME Section VIII, Pressure Vessels*, American Society of Mechanical Engineers, New York, New York.

ASTM, 1989, *1989 Annual Book of ASTM Standards*, American Society for Testing and Materials, Philadelphia, Pennsylvania.

DOE-RL, 1988, "Design Load for Structures, *Hanford Plant Standards*, HPS-SDC-4.1, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE-RL, 1991a, *242-A Evaporator Dangerous Waste Permit Application*, DOE/RL-90-42, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

DOE-RL, 1991b, "Equipment Decontamination", correspondence from E.A. Bracken to T.L. Nord, number 9102456, dated June 5, 1991, U.S. Department of Energy Field Office, Richland, Richland, Washington.

DOE-RL, 1991c, *Liquid Effluent Retention Facility Dangerous Waste Permit Application*, DOE/RL-90-43, U.S. Department of Energy-Richland Operations Office, Richland, Washington.

Ecology, EPA, and DOE, 1990, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Olympia, Washington.

EPA, 1979, *Methods for Chemical Analysis of Water*, EPA-600/4/79/020, revised March 1979, Revised December 1989, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1983, *Interim Guidelines and Specifications for Preparing Quality Assurance Projects Plans*, QAMS-005/80, EPA-600/4-83/004, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1986a, *Guidance Manual for Research, Development, and Demonstration Permits Under 40 CFR Section 270.65*, EPA/530-SW-86-008, U.S. Environmental Protection Agency, Office of Solid Waste Permits and State Programs Division, Washington, D.C.

EPA, 1986b, *Test Methods for the Evaluation of Solid Waste: Physical/Chemical Methods*, SW-846, 3rd ed., Supplement issued 1990, U.S. Environmental Protection Agency, Washington, D.C.

EPA, 1989, *Docket Report on Health-Based Levels and Solubilities Use in the Evaluation of Delisting Petitions, Submitted Under 40 CFR 260.20 and 260.22*, November 1989, U.S. Environmental Protection Agency, Office of Solid Waste, Washington, D.C.

EPA, 1991, *A Project Manager's Guide to Requesting and Evaluating Chemical Analysis*, EPA 910/9-90-024, U.S. Environmental Protection Agency, Washington, D.C.

NIOSH 1985, *National Institute for Occupational Safety and Health Pocket Guide to Chemical Hazards, DHHS (NIOSH)*, Publication No. 85-114, U.S. Department of Health and Human Services, Washington D.C.

U.S. Weather Bureau, 1961, *Rainfall Frequency Atlas of the United States*, Technical Paper No. 40, U.S. Government Printing Office, Washington D.C.

WHC, 1990, *Inventory of Chemicals Used at Hanford Site Production Plants and Support Operations (1944-1980)*, WHC-ET-0172, Rev. 1, Westinghouse Hanford Company, Richland, Washington.

WSDOT, 1991, *1991 Standard Specifications for Road, Bridge, and Municipal Construction*, M41-10, Section 9-03.8, Washington State Department of Transportation, Olympia, Washington.

10.2 CODE OF FEDERAL REGULATIONS AND FEDERAL REGISTER

29 CFR 1910, *Occupational Safety and Health Standards*

40 CFR 136, *Guidelines for Establishing Test Procedures for the Analysis of Pollutants*

40 CFR 260, *Hazardous Waste Management System: General*

40 CFR 261, *Identification and Listing of Hazardous Waste*

40 CFR 262, *Standards Applicable to Generators of Hazardous Waste*

40 CFR 263, *Standards Applicable to Transporters of Hazardous Waste*

40 CFR 264, *Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*

40 CFR 265, *Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities*

40 CFR 266, *Standards for the Management of Specific Hazardous Wastes and Specific Types of Hazardous Waste Management Facilities*

40 CFR 267, *Interim Standards for Owners and Operators of New Hazardous Waste Land Disposal Facilities*

40 CFR 268, *Land Disposal Restrictions*

40 CFR 270, *EPA Administered Permit Programs: The Hazardous Waste Permit Program*

49 CFR 172, *Hazardous Materials Tables and Hazardous Materials Communications Regulations*

49 CFR 173, *Shippers-General Requirements for Shipments and Packagings*

10.3 FEDERAL AND STATE ACTS

Atomic Energy Act of 1954, as amended, 42 USC 2011.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 USC 9601 et seq.

Hazardous and Solid Waste Amendments of 1984, 42 USC 6912(a), 6921, 6922, 6924, 6925, 6926, 6930, 6935, 6937, 6939, 6991, and 6993.

Privacy Act of 1974, as amended, 5 USC 552a.

Resource Conservation and Recovery Act of 1976, as amended, 42 USC 6901 et seq.

State of Washington Hazardous Waste Management Act of 1976, as amended, Revised Code of Washington, Chapter 70.105, Olympia, Washington.

10.4 WASHINGTON ADMINISTRATIVE CODE

WAC 173-303, *Dangerous Waste Regulations*, Washington State Department of Ecology, Olympia, Washington.

10.5 THE U.S. DEPARTMENT OF ENERGY ORDERS

5480.1A, *Environment, Safety, and Health Program for Department of Energy Operations for Richland Operations*, U.S. Department of Energy, Washington, D.C.

5480.6, *Safety of Department of Energy-Owned Nuclear Reactors*, U.S. Department of Energy, Washington, D.C.

5484.1, *Environmental Protection, Safety, and Health Protection Information Reporting Requirements*, U.S. Department of Energy, Washington, D.C.

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APPENDICES

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ENGINEERING CHANGE NOTICE

1. ECN 119506	Proj. ECN		
2. ECN Category (mark one): Supplemental [XX]; Direct Revision [ ]; Change ECN [ ]; Temporary [ ]; Supersedure [ ]; Discovery [ ]; Cancel/Void [ ]	3. Originator's Name, Organization, MSIN, and Telephone No.: D.E. SCULLY, 86330, R3-45, 372-3592		4. Date: 12/16/92
	5. Project Title/No./Work Order No.: C-018H	6. Bldg./Sys./Fac. No.: 200 Area	7. Impact Level: 4
	8. Document Number Affected (include rev. and sheet no.): WHC-SD-C018H-QAPP-002, Rev 2	9. Related ECN No(s).: N/A	10. Related PO No.: N/A
11a. Modification Work: [ ] Yes (fill out Blk. 11b); [XX] No (NA Blks. 11b, 11c, 11d)	11b. Work Package Doc. No.: N/A	11c. Complete Installation Work: N/A — Cog. Engineer Signature & Date	11d. Complete Restoration (Temp. ECN only): N/A — Cog. Engineer Signature & Date

12. Description of Change

Replace the last sentence on page 1-1 with the following: "The waste is designated dangerous due to the presence of spent solvents (F001, F002, F003, and F005) and the concentration of ammonia (WT02).

13a. Justification (mark one)	13b. Justification Details
Criteria Change [ ]	Recent information has indicated the presence of certain halogenated solvents (F001, F002) in underground storage tank waste.
Design Improvement [ ]	
Environmental [ ]	
As-Found [XX]	
Facilitate Const. [ ]	
Const. Error/Omission [ ]	
Design Error/Omission [ ]	

14. Distribution (include name, MSIN, and no. of copies)

D.E. Scully	2 + 2 advance	R3-45
D.J. Sommer	1	R1-48
D.R. Speer	1	R1-48
IRA	1	R1-08

RELEASE STAMP

OFFICIAL RELEASE BY WHC
DATE DEC 17 1992
STA 4

ENGINEERING CHANGE NOTICE

1. ECN (use no. from pg. 1): 119506

15. Design Verification Required
- [ ] Yes
- [x] No

16. Cost Impact — ENGINEERING: NA

	ENGINEERING	CONSTRUCTION
Additional	☐ $	☐ $
Savings	☐ $	☐ $

17. Schedule Impact (days): NA
- Improvement ☐
- Delay ☐

18. Change Impact Review: Indicate the related documents (other than the engineering documents identified on Side 1) that will be affected by the change described in Block 12. Enter the affected document number in Block 19.

SDD/DD None	☐	Seismic/Stress Analysis	☐	Tank Calibration Manual	☐
Functional Design Criteria	☐	Stress/Design Report	☐	Health Physics Procedure	☐
Operating Specification	☐	Interface Control Drawing	☐	Spares Multiple Unit Listing	☐
Criticality Specification	☐	Calibration Procedure	☐	Test Procedures/Specification	☐
Conceptual Design Report	☐	Installation Procedure	☐	Component Index	☐
Equipment Spec.	☐	Maintenance Procedure	☐	ASME Coded Item	☐
Const. Spec.	☐	Engineering Procedure	☐	Human Factor Consideration	☐
Procurement Spec.	☐	Operating Instruction	☐	Computer Software	☐
Vendor Information	☐	Operating Procedure	☐	Electric Circuit Schedule	☐
OM Manual	☐	Operational Safety Requirement	☐	ICRS Procedure	☐
FSAR/SAR	☐	IEFD Drawing	☐	Process Control Manual/Plan	☐
Safety Equipment List	☐	Cell Arrangement Drawing	☐	Process Flow Chart	☐
Radiation Work Permit	☐	Essential Material Specification	☐	Purchase Requisition	☐
Environmental Impact Statement	☐	Fac. Proc. Samp. Schedule	☐		☐
Environmental Report	☐	Inspection Plan	☐		☐
Environmental Permit	☐	Inventory Adjustment Request	☐		☐

19. Other Affected Documents: (NOTE: Documents listed below will not be revised by this ECN.) Signatures below indicate that the signing organization has been notified of other affected documents listed below.

Document Number/Revision	Document Number/Revision	Document Number/Revision
none		

20. Approvals

	Signature	Date
OPERATIONS AND ENGINEERING		
Cog./Project Engineer	D E Scully	12/16/92
Cog./Project Engr. Mgr.	[illegible signature]	12/16/92
QA		
Safety		
Security		
Proj.Prog./Dept. Mgr.		
Def. React. Div.		
Chem. Proc. Div.		
Def Wst. Mgmt. Div.		
Adv. React. Dev. Div.		
Proj. Dept.		
Environ. Div.		
IRM Dept.		
Facility Rep. (Ops)		
Other		

	Signature	Date
ARCHITECT-ENGINEER		
PE		
QA		
Safety		
Design		
Other		
DEPARTMENT OF ENERGY		
ADDITIONAL		

1.0 INTRODUCTION

Waste waters have been generated as result of operations conducted at the Hanford Facility for over 40 years. These waste waters were previously discharged to cribs, ponds, or ditches. Examples of such waste waters include steam condensates and cooling waters that have not been in contact with dangerous or mixed waste and process condensates that are derived from dangerous or mixed waste.

Many measures have been taken to reduce the amount of contamination being discharged in these effluents. However, some of these waste waters still require additional treatment before release to the environment. Systems are being designed and built to treat these waste waters along with any future waste waters resulting from remediation activities on the Hanford Facility.

The waste waters typically contain trace levels of radionuclides and stable chemicals. Both organic and inorganic constituents normally are present and can be suspended solids or dissolved solids. While there is a wide variety of contamination in the waste waters, the level of contamination is very low. For example, the non-contact cooling water closely resembles the composition of Columbia River water; and the composition of the steam condensates and process condensate closely resembles that of distilled water.

Several treatment systems will be built on the Hanford Facility to treat waste waters. Before the treatment systems are constructed, the systems will need to be tested to verify that the treatment methods selected are effective. Usually this testing will be performed on a small-scale and is termed "pilot testing." Some testing will be conducted at the 2703E Chemical Engineering Laboratory and other onsite support laboratories. A room in the 1706-KE Engineering and Environmental Demonstration Laboratory (EEDL) (an existing structure in the 100K Area) has been selected as the site for most of the testing. Some testing (to support Project C-018H) will also be performed at the Liquid Effluent Retention Facility (LERF) located in the 200 East Area. Testing usually will be performed in two testing programs; the first program will use synthetic waste and the second program will use actual dangerous or mixed waste.

One of the first treatment systems to be constructed will treat the process condensate from the 242-A Evaporator. This will be part of the pilot plant treatability testing required to support Project C-018H, "242-A/PUREX Plant Condensate Treatment Facility." The 242-A Evaporator concentrates various liquid waste generated on the Hanford Facility. The liquid waste is stored in underground double-shell tanks (DSTs). The liquid waste in the DSTs is piped to the 242-A Evaporator, concentrated through evaporation, and returned to the DSTs for storage until final disposal. The condensate derived from this evaporation process, called "242-A Evaporator process condensate," is the waste water that will be tested. This waste water is a dangerous waste as defined by WAC 173-303. The waste is designated dangerous due to the presence of spent solvents (F003, and F005) and the concentration of ammonia (WT02).

1.1 PURPOSE

The treatability testing must be completed before construction of full-scale treatment systems. This testing is needed to:

- Demonstrate the technical adequacy, economic feasibility, and performance capability of new and innovative treatment technologies
- Tailor existing treatment technologies to site-specific design needs and operating conditions
- Improve the efficiency of treatment processes, refine performance capabilities, and reduce secondary waste resulting from treatment processes
- Demonstrate that treatment systems produce a treated waste water that is nonhazardous
- Provide data to support the preparation of the required environmental permits, delisting petitions, or other regulator approvals
- Provide the U.S. Department of Energy Field Office, Richland (RL) with a level of confidence that the treatment system will operate within the limits established by the environmental permits
- Provide data for full scale plant design

1.2 GENERAL WASTE WATER PILOT PLANT DESCRIPTION

Waste water pilot plant testing within the scope of this QAPP will be conducted at several locations on the Hanford Site.

- Non-radioactive waste waters (synthetic and actual) can be tested at the 2703E Chemical Engineering Laboratory (CEL). Preliminary testing of Project C-018H synthetic waste water will be conducted at the CEL.
- Most of the testing of filtration processes to support Project C-018H will be conducted at the LERF. The LERF consists of four 6.5-Mgal (24.6-ML) surface impoundments (basins) located on a 39-acre site east of the 200 East Area. The LERF receives process condensate from the 242-A Evaporator.
- Testing of synthetic, radioactive and dangerous waste will be conducted in the 1706-KE EEDL. The EEDL is located in the 100 Area. To support Project C-018H, waste water will be transported from the LERF to the EEDL by two 5,000 gal (18,927 L) tanker trucks.
- Other onsite laboratories may be utilized to conduct bench scale testing of synthetic and actual waste waters.

WASTE WATER PILOT PLANT

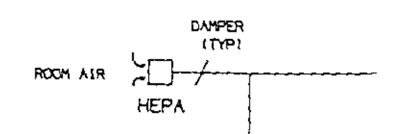
STREAM CHARACTERISTICS

	(3)	(4)	(5)	(6)	(7)	(8)
FEED	pH OUT	FILTRATE	PEROXIDE FEED	UV/OX OUT	RO PERMEATE	RO RETENTATE
.4	5	5	0.004	5-25	4.5	0.5
70	60 - 70	60 - 70	60 - 70	60 - 90	60 - 70	60 - 70
	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5	5 - 6.5
	11.0	11.0	-	<1.0	<1.0	<1.0
04	-	-	50% H2O2	-	-	-

TANK TABLE

TANK	QUANTITY	CAPACITY (GALLONS)
FEED TANKER	1	5,000
H2SO4 ACID FEED	1	30
FILTRATE STORAGE	1	100
UV/OX FEED SURGE	1	200
H2O2 SUPPLY	1	55
RO FEED SURGE	1	100
RETENTATE [illegible]	[illegible]	[illegible]

VOC ANALYZER



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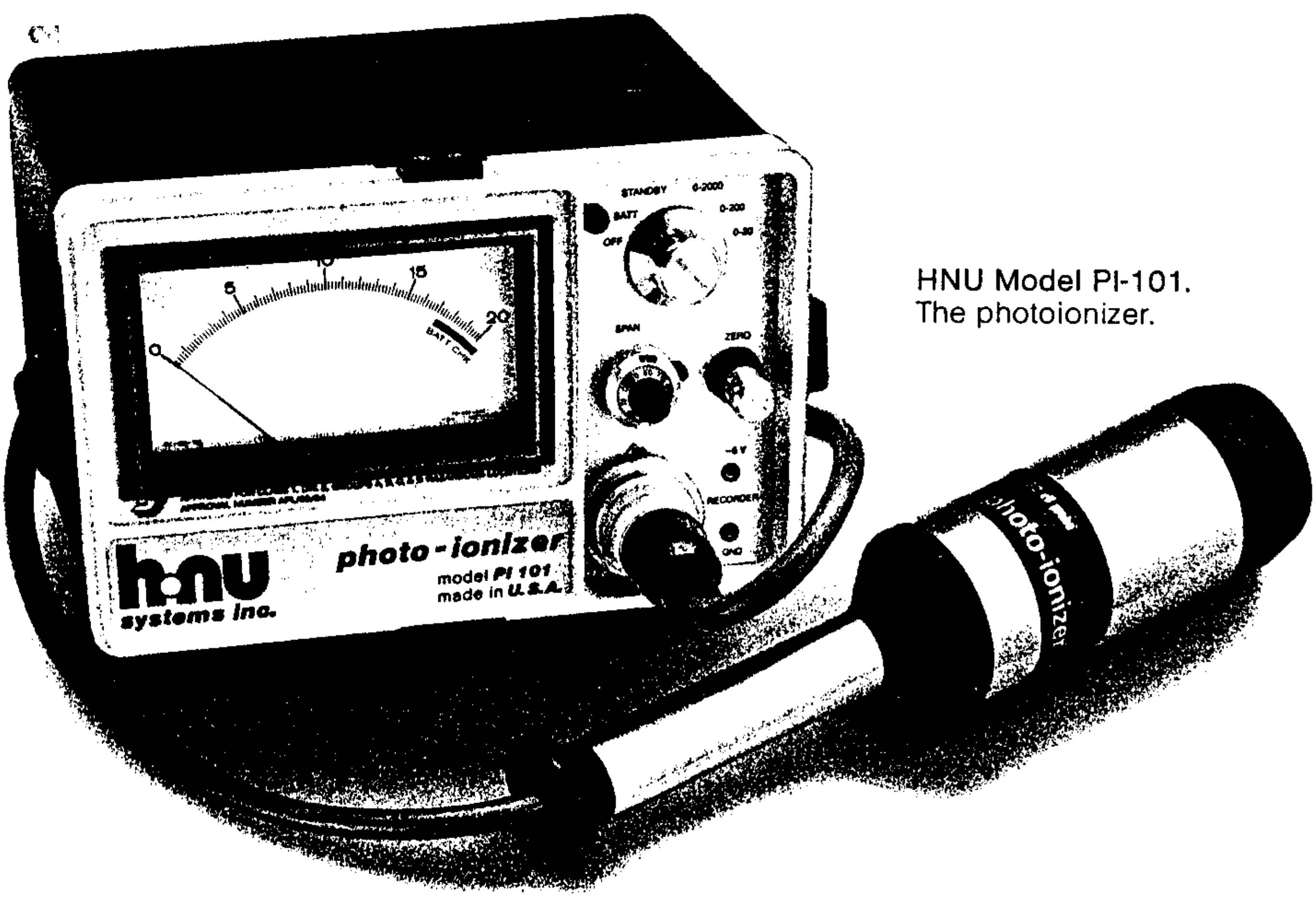
trace gas analysis by photoionization



HNU Model PI-101.
The photoionizer.

APPROVED FOR CLASS I, DIV. II, GROUPS A, B, C & D HAZARDOUS LOCATIONS
APPROVAL NUMBER APL/33/84

HNU Systems, Inc., 160 Charlemont Street, Newton, Massachusetts, 02161-9987 **chemical instrumentation**

the photo-ionizer is a portable trace gas analyzer that can be used to measure a wide variety of organic vapors including chlorinated hydrocarbons, heterocyclics and aromatics, aldehydes and ketones as well as several inorganic gases including hydrogen sulfide and ammonia.

The instrument uses the principle of photoionization as the analytical technique and overcomes many of the problems inherent in current trace gas analysis instrumentation. These problems presently include poor limits of detection, slow and sluggish time response, background electronic noise or drift and a lengthy series of precise technical operations necessary to properly use the instrumentation. In addition, many of today's portable analyzers remain heavy, cumbersome instruments that require additional portable equipment such as sample pumps or compressed fuel and zero gases or bulky power packs for operation.

The advanced technology employed in the photo-ionizer successfully overcomes these disadvantages. For example, the limit of detection for most species is extended down to 0.1 ppm—an increase of 10–100 fold over many conventional instruments—while still maintaining a wide dynamic operating range (0.2 to 2000 ppm). This improved sensitivity allows industrial hygienists to make measurements at or below the TLV's (threshold limit values) established by OSHA.

Time response is greatly improved by several design advances. The location of the sensing chamber at the sampling point in the hand-held probe, the fabrication of all sample contact areas with inert fluorocarbon materials and a rapid sample flow through a small analyzing chamber eliminate sample hang up (adsorption) and minimize sample transit time in the instrument. The problems of delayed time response and instrument sluggishness are eliminated. Total time response to 90% of a full scale concentration change (0–2000 ppm) is less than five seconds—a significant feature when the instrument is used to locate plant "hot spots" or to detect leaks.

All solid state electronics and state-of-the-art circuit design have virtually eliminated conventional instrument drift and background noise. Zero drift is less than 1% over 10 hours. The excellent stability and drift free electronics allow accurate measurements, even at very low concentrations.

The Model PI 101 is one of the simplest analytical instruments to use since it has only three operating controls and unskilled personnel are easily and quickly trained to operate it. An easy to read 4½" *linear* scale provides a readout directly in units of concentration (ppm). Other features include an electronic zero that eliminates the use of a zero gas, and instrument calibrations that hold for weeks. The elimination of a flame, igniters and compressed hydrogen fuel make the photo-ionizer simpler to use than a flame ionization analyzer while providing an unusually safe instrument.

This lightweight (less than nine pounds) instrument was designed primarily as a portable analyzer for survey work and leak detection. However, the unit can also be set up as a continuous stationary monitor powered by 110V through its battery recharger/converter system. A strip chart recorder can be attached to the outputs (0–5V) provided.

Further details about the principle of operation and the significant technical advances this instrument provides are described in the following pages. Additional technical literature regarding your particular application and the photo-ionizer's response and sensitivity to the particular species of interest is available upon request.

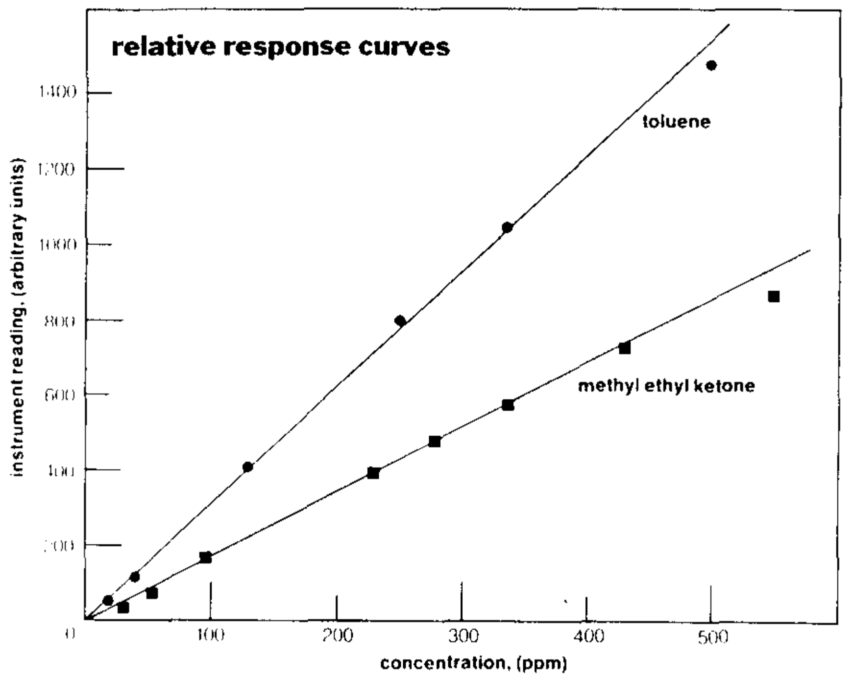
Write, call, or use the attached postage paid reply card for further information.

principle of operation

The photo-ionizer is a trace gas analyzer used to measure the concentration of a wide variety of species in industrial atmospheres. The analyzer employs the principle of photoionization for detection. The process is termed photoionization since the absorption of ultraviolet light by a molecule leads to ionization via: $R + h\nu \rightarrow R^+ + e^-$ where R^+ is the ionized species and $h\nu$ represents a photon which has an energy $\geq$ the ionization potential of the species.

The sensor consists of a sealed ultraviolet light source that emits photons which are energetic enough to ionize many trace species (particularly organics) but do not ionize the major components of air such as O_2, N_2, CO, CO_2, or H_2O. A chamber adjacent to the ultraviolet source contains a pair of electrodes. When a positive potential is applied to one electrode the field created drives any ions formed by the absorption of UV light to the collector electrode where the current (proportional to the concentration) is measured. Typical calibration curves showing the relative response of toluene and methyl ethyl ketone (at the same gain setting) are shown below.

Information on the relative response factors for other species is available upon request.



the photo-ionizer — accurate measurements, easily obtained

sensitivity A maximum sensitivity of 0–2 ppm, full scale, can be obtained for many species. This scale is readable to 1% (100 division scale).

limits of detection Typical limits of detection are 0.2 ppm. In many cases these lower limits represent a 10–100 fold improvement over conventional portable analyzers.

operating range The linear range for most compounds is from 0.1 ppm to 600 ppm while the useful range typically extends to 2000 ppm.

stability Zero drift is extremely low, normally 1% or less over 10 hours, on battery operation. On AC operation, zero drift is less than 1% over 24 hours. Semiweekly span calibrations (100 ppm toluene) over a one month period give a relative standard deviation of ±4.5%. This long term stability of both zero and span is due to the solid state electronics and stable ultraviolet light source.

specificity Specificity in photoionization analysis depends on the sensitivity of the detector to the species being measured, the number of interfering species present, and the concentration of the species being measured relative to interferences. The optimum specificity can be obtained by choosing the light source (9.5 eV, 10.2 eV, 11.7 eV) to suit the application, maximizing sensitivity to the species being analyzed and minimizing any possible interference. Return the postcard for details on your application.

rapid response Response to changes in concentration is extremely rapid. A 90% of full scale change (0–2000 ppm) takes less than five seconds. In addition, the sensor is located at the sampling point rather than inside the instrument. This eliminates the problems of hydrocarbon adsorption and transit time through a sampling tube, all of which can delay the real time response by 30–45 seconds or more.

photo courtesy of Ecology and Environment, Inc.

Intrins. Hazar and G versio

AC/DC operation — The instrument power is supplied from a 12 VDC rechargeable battery which gives a *minimum* of 10 operating hours before recharging is necessary. The AC recharger provides the option of operating the unit continuously from 110V AC so that the instrument can be used either as a portable unit for industrial hygiene surveys and leak detection work or as a continuous stationary monitor. An optional HNU Recorder can also be operated with the 101 battery.

The instrument is equipped with an automatic solid state battery protection circuit to prolong battery life by preventing deep discharging. Both the analyzer and the recorder can be operated during the recharge cycle.

portability The instrument is truly portable, with a total weight of less than 9 pounds (4.1 Kg) complete. No additional bulky power packs, sample pumps or cylinders of fuel gas or zero gas are needed. When not in use, the hand-held sensor is stored in the instrument cover and the total package measures 21 cm wide x 13 cm deep x 24 cm high.

direct reading Concentration (ppm) is read out directly on an easy to read 4.5" (11.3 cm) *linear* scale.

three simple operating controls

Function and Range Switch This switch puts the instrument into the STANDBY, BATTERY CHECK, MEASUREMENT modes or OFF position. The MEASUREMENT position allows the choice of a 0-2 ppm, 0-20 ppm, 0-200 ppm or 0-2000 ppm full scale range. The STANDBY mode reduces power consumption between measurements. The BATTERY CHECK allows a manual power check before use while an LED (red indicator light) adjacent to the function switch provides an automatic battery check indicator during operation.

Zero Adjust The zero control allows electronic calibration of the instrument at the zero concentration point without requiring the use of a zero gas.

Span To calibrate the instrument for a particular gas, this control is adjusted to the gain setting which will match the value of a calibration gas to that same reading on the instrument scale. This control also provides the 10 fold increase in gain that allows the 0-2 ppm full scale range.

IS-101),
(HW-101),
ose (GP-101)
lable.

recorder outputs A signal output of 0—5V full scale is provided on the front panel for the attachment of a strip chart recorder.

electronic zero Zero calibration is done completely electronically. The instrument is switched to the STANDBY mode where the UV light source is turned off but the other electronics remain on. The zero control is adjusted until the meter indication is zero. No zero gas or regulators are needed; no further adjustments are required. Verification tests for this technique against hydrocarbon-free zero gas show perfect agreement.

safety ***The photo-ionizer is extremely safe to use, requiring no flames, igniters, or hydrogen fuel. Versions are available for use in General Purpose, Hazardous Waste; Class I, Division II and Class I, Division I, Group ABCD areas.***

instant warmup Solid state electronics produce stable readings within 20 seconds after turning the instrument on.

selected list of species detected

NR: no response
H: high response
L: low response

class / species	**photoionization response** 9.5 eV lamp	10.2 eV lamp	11.7 eV lamp
paraffins and unsaturated hydrocarbons			
methane	NR	NR	NR
ethylene	NR	L	H
acetylene	NR	NR	H
1-butene	H	H	H
hexane	NR	L	H
chlorinated hydrocarbons			
methyl chloride	NR	NR	H
carbon tetrachloride	NR	NR	H
chloroform	NR	NR	H
dichloroethane	NR	NR	H
vinylidene chloride	L	H	H
vinyl chloride	L	H	H
trichloroethylene	H	H	H
heterocyclics & aromatics			
phenol	H	H	H
pyridine	H	H	H
benzene	H	H	H
toluene	H	H	H
xylene	H	H	H
styrene	H	H	H
aniline	H	H	H
chlorobenzene	H	H	H
nitrobenzene	NR	L	H
nitrogen compounds			
formamide	NR	H	H
ammonia	NR	L	H
hydrazine	H	H	H
methyl amine	H	H	H
acetonitrile	NR	NR	NR
acrylonitrile	NR	NR	H
sulfur compounds			
sulfur dioxide	NR	NR	NR
hydrogen sulfide	NR	H	H
carbonyl sulfide	NR	NR	H
carbon disulfide	H	H	H
methyl mercaptan	H	H	H
dimethyl sulfide	H	H	H
dimethyl disulfide	H	H	H
aldehydes, ketones, alcohols, acids, esters			
formaldehyde	NR	NR	H
acetaldehyde	NR	H	H
propionaldehyde	L	H	H
acrolein	L	H	H
crotonaldehyde	L	H	H
acetone	L	H	H
methanol	NR	NR	H
ethanol	NR	L	H
formic acid	NR	NR	H
acetic acid	NR	L	H
methyl methacrylate	L	H	H
others			
ethylene dibromide	NR	H	H
ethylene oxide	NR	L	H
tetraethyl lead	H	H	H
phosphine	NR	H	H
arsine	NR	H	H
iodine	H	H	H

hnu
HNU Systems, Inc., 160 Charlemont Street, Newton, Massachusetts, 02161-9987 **chemical instrumentation**

specifications

performance (benzene referred)
- **range** 0.2 to 2000 ppm
- **detection limit** 0.2ppm
- **sensitivity** (max) 0-2 ppm FSD over 100 division meter scale
- **repeatability** ±1% of FSD
- **linear range** 0.1 to 600 ppm
- **useful range** 0.1 to 2000 ppm
- **response time** <5 sec to 90% of full scale

physical
- **size**: probe 6.3 DIA x 28.5L (cm) (2½ x 11¼")
  - readout 21W x 13D x 16.5H (cm) (8¼ x 5³⁄₁₆ x 6½")
  - stowed 21W x 13D x 24H (cm) (8¼ x 5³⁄₁₆ x 9½")
  - cable 80 cm long (32")
- **weight** probe .55kg (20 ounces)
  - readout 3.2kg (7 pounds)
  - total (shipping) 5.4 kg (12 pounds)

controls and functions
- **mode switch** Off, Battery check, Standby (zero), 0-2000, 0-200, 0-20 ppm
- **low battery indicator light**
- **zero** (10 turn ±300% FSD max)
- **span** (10 turn counting dial 1.0 to 10 times nominal sensitivity)
- **readout** 4½" (11.3 cm) meter Taut Band movement graduated 0-5-10-15-20, divisions
- **outputs** recorder 0-5 VDC

power requirements of operating times
- continuous use with battery > 10 hours
  - with HNU Recorder > 6 hours
- recharge time, max < 14 hours, 3 hours to 90% of full charge
- recharge current, max .4 amps @ 115 VAC

construction Designed to withstand the shock and abuse to which portable instruments are often subjected.
The readout is housed in a two piece aluminum case, and finished with a solvent resistant baked acrylic textured paint.
The probe is fabricated from extruded aluminum sections and machined plastic.

serviceability The probe and readout are of a modular design allowing rapid servicing and/or replacement of mechanical and electrical components. All module interwiring includes quick disconnects.

maintenance The instrument contains only one moving part, and consumes no gases or reagents. The only routine maintenance procedure is cleaning the light source window every several weeks.

applications

industrial hygiene surveys of toxic gases for OSHA (TLV) compliance can be rapidly accomplished with this portable, direct reading instrument. Hood ventilation rates can also be measured accurately because of the sensitivity and wide operating range of the unit.

leak detection is facilitated by the rapid instrument response and extreme sensitivity. This enables the user to locate even small leaks very rapidly.

residual solvent vapors such as trichloroethylene in decaffeinated coffee or degreasing operations, hexane from soybean extraction and other vapors from **food, chemical processing, paint spraying** or coating can be easily and rapidly measured.

benzene concentrations as low as .1 ppm can be selectively measured using a 9.5 eV lamp. This lamp eliminates most common interferences.

non methane hydrocarbons in the atmosphere can be **measured directly** since the photoionizer does not respond to methane.

vinyl chloride measurements in monomer plants can be made without interference from major starting materials or by-products such as ethylene and ethylene dichloride (dichloroethane). Low level vinyl chloride measurements in PVC fabrication processes do not have the 1-2 ppm methane background interference seen in other portable instruments.

For additional information on specific applications, please fill out the attached postage-paid reply card or call us at (617)964-6690. To place an order, call us toll-free at (800)527-4566.

represented by

Tegal Scientific, Inc.
No. Cal.: (415) 827-1054
So. Cal.: (800) 642-0251
Outside Cal.: (800) 227-2012
P. O. Box 5905
Concord, CA 94524

hnu®

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HNU Systems (Canada), Ltd., 85 Albert Street, Suite 1610, Ottawa, Ontario K1P 6A4 Canada Tel: (613)563-3674 Telex:0533198 Fax:(613)563-1992
HNU Systems, Ltd., 254 Europa Boulevard, Gemini Business Park, Warrington WA5 5TN England Tel:0925 445941 Fax:0925 445940
HNU GmbH, Lindenstrasse 10, 8034 Germering, West Germany Tel:089 841 9009 Fax:089 840 2669

APPENDIX 4E

MANUFACTURER'S DATA ON PORTABLE BERMS

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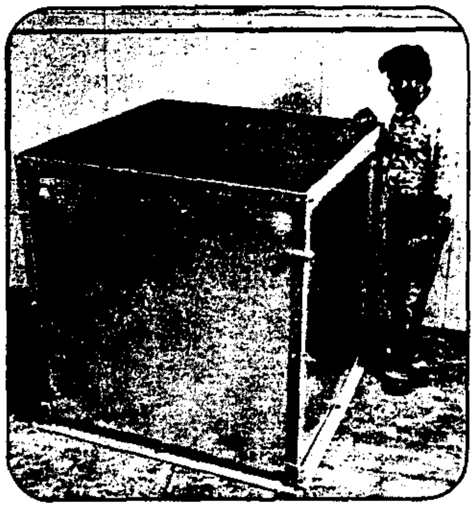
Compakt™ TANKS 250 GALLONS & UP



Small capacity ComPakt tanks are engineered for permanent or standby fluid storage indoors or outdoors. ComPakt modular parts are designed to be hand carried through doorways for assembly in tight, hard-to-reach places. Solar heating, hazardous waste handling, potable water systems and pollution control are some of the many uses for ComPakt tanks.

COMPAKT PREFABRICATED COMPONENTS – All ComPakt models are assembled from modular steel panels and steel support posts. Panels and posts can be hand-carried by one or two workmen through doorways for interior assembly in tight places.

INSTALLATION SPEED – 1,500 gallon ComPakt can be assembled ready-for-use in under three hours by two unskilled workers using ordinary hand tools. All components are easily hand carried by one or two people.

LINERS – ComPakts are supplied with one piece fitted PVC liners that totally enclose their contents. A wide range of flexible membrane liners for potable and high temperature (200°F) water, or more corrosive chemical liquids, is available.

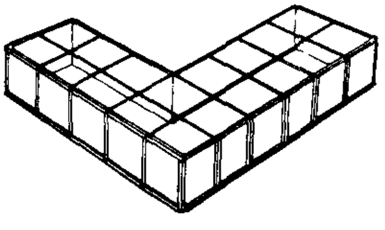
COVERS – Galvanized steel, top covers can be easily and securely installed on the tank's broad top rails.

PIPING – The ComPakt conveniently accepts bulkhead fittings for through-the-wall or over-the-top pipes. Bottom drains can also be installed.

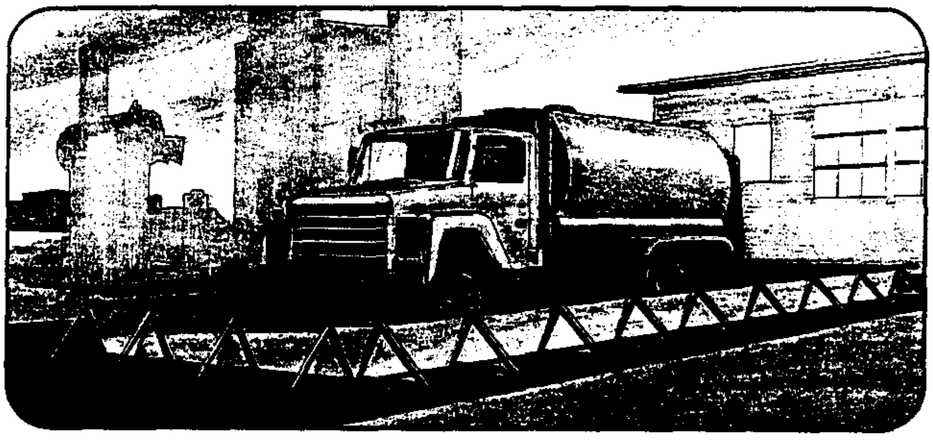
INSULATION – ComPakts readily accept standard insulation materials, fitted internally, wrapped around the outside, or in a combination of both methods.

COMPAKT GENERAL SPECIFICATIONS – Wall panels are mil galvanized steel. Structural members are hot dip galvanized steel angle. Liner is 20 mil PVC or HDPE.

SPECIAL SHAPES – ComPakt tank modular components can be assembled into "L" - "T" - "Cross" or almost any shape with right angle corners.



SpilGard™ TANKER TRUCK SPILL CONTAINMENT



SpilGard containment systems are specifically designed to contain accidental tanker truck spills at loading, unloading and storage points.

SpilGard containment systems are designed for permanent or temporary installation around tanker truck loading points. Truck access is gained through a movable wall or fixed ramp. Several different designs are available depending upon specific requirements,.

INSTALLATION SPEED – SpilGard modular steel components are designed for easy hand carrying and rapid bolt-together assembly by unskilled workers following a step-by-step manual. A typical SpilGard containment can be ready for use in less than two hours.

MEMBRANE LINERS – A wide variety of membrane liner materials is available including HDPE, XR-5, PVC and polyurethane.

SIZES – Modular components allow assembly of SpilGard tanks large enough to contain any size tanker truck.

Engineered Containment Systems Since 1970

Since 1970, ModuTank Inc. and its affiliates have engineered and fabricated a unique family of above-ground liquid containment tanks,. Low in cost, these modular tanks for indoor and outdoor locations are shipped K.D., are easily and rapidly assembled, and require little or no site preparation. The following pages fully detail these versatile systems.

Our tanks have been accepted and specified by engineering firms, consultants, and environmental agencies and purchased by Fortune 500 industries, State and Federal agencies, utilities, and municipalities nationwide. Included among their many applications are:

- Storage and processing of sewage, waste water, sludge, slurries and soils
- Water treatment, reclamation, and storage
- Emergency response and spillage cleanup
- Chemical storage
- Solar heating and evaporation
- OEM system components

Our standard tanks can also be tailored for special needs requiring such features as sumps, piping, leak detection, customized dimensions and covers. Please contact us about your particular requirements. Our technical staff is experienced in solving unique and difficult storage problems.

BUY BACK PLAN

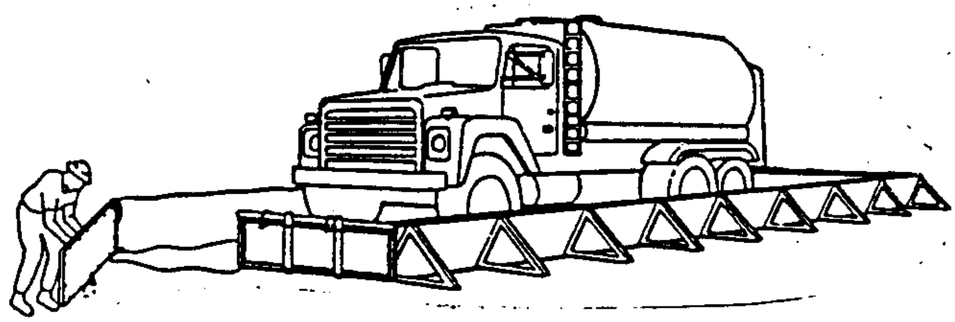
For short term use applications, ModuTank Inc. offers a buy-back plan under which a substantial portion of the original purchase price is repaid to the purchaser upon the return of the tanks. Details on this cost savings plan will be furnished upon request.

SEISMIC 4

ModuTanks designed to meet requirements for earthquake resistance are available. These heavy duty tanks are certified to withstand seismic 4 conditions.

ModuTank Inc.
41-04 35th Ave., Long Island City, NY 11101 (718) 392-1112 Fax (718) 786-1008

SpilGard Assembly Instructions



— IMPORTANT —

Read instructions completely before starting assembly of your tank. All parts are prefabricated and bolt together with the supplied hardware. Check all parts against parts list. File claim for missing or damaged parts immediately. Contact ModuTank for prices.

DATE	PO NUMBER

BILL TO

NAME OF JOB ______________________

ADDRESS ______________________

CITY ______________________ STATE ______ ZIP ______

CONTACT ______________________

PHONE ( ) ______________________

SHIP TO

NAME OF JOB ______________________

ADDRESS ______________________

CITY ______________________ STATE ______ ZIP ______

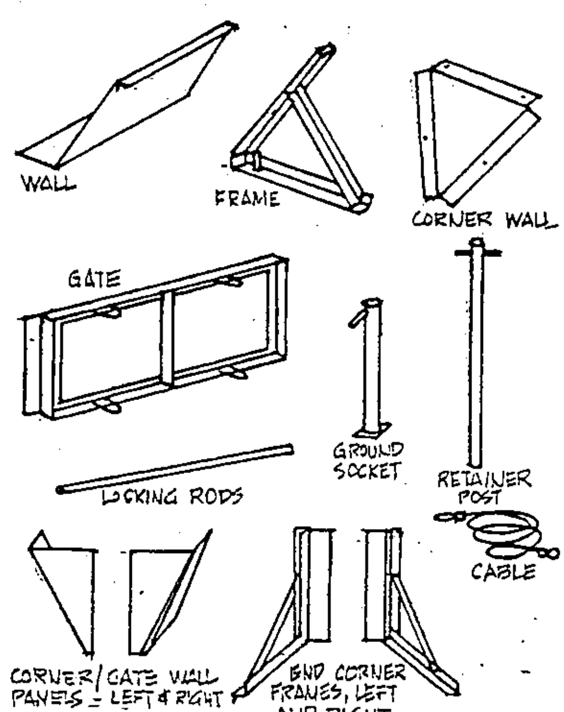
CONTACT ______________________

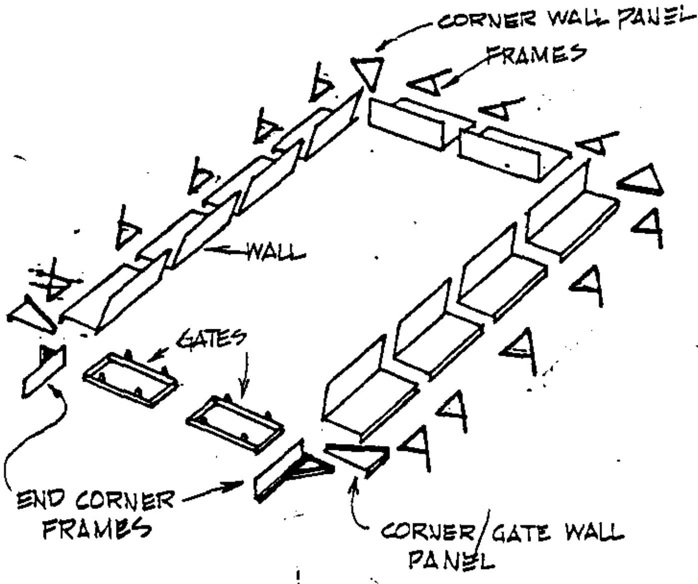
PHONE ( ) ______________________

PARTS LIST/PACKING LIST

INSIDE DIMENSIONS ________ X ________ WALL PANELS ON EACH SIDE ________ X ________ FRAMES ON EACH SIDE ________ X ________

PART NO. AND NAME	QUANTITY	CHECK BOX

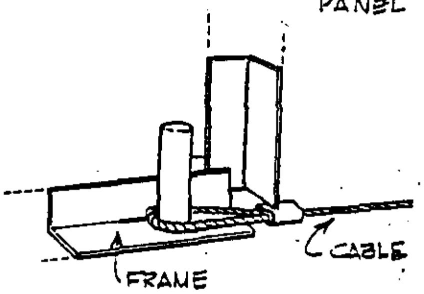




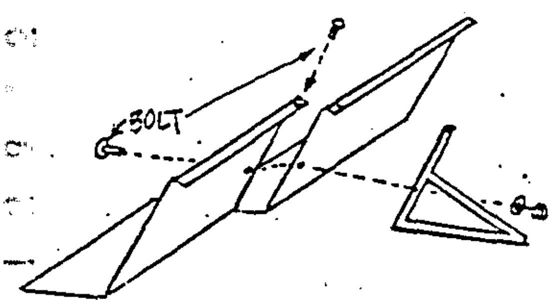
1. CHECK PARTS AGAINST PARTS LIST. CHECK SHIPMENT FOR HIDDEN DAMAGE AND MISSING PARTS.

2. LAYOUT INSIDE DIMENSIONS OF TANK ON GROUND WITH A CHALK LINE.

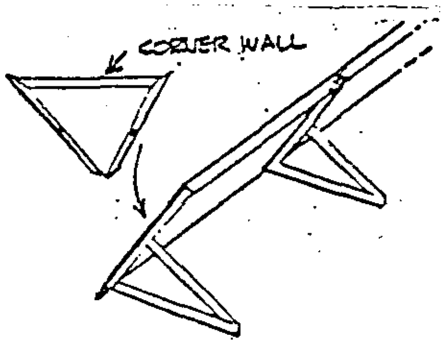
3. PLACE PANELS, FRAMES, GATES, GROUND SOCKETS AND CABLES ON GROUND OUTSIDE CHALK LINE.



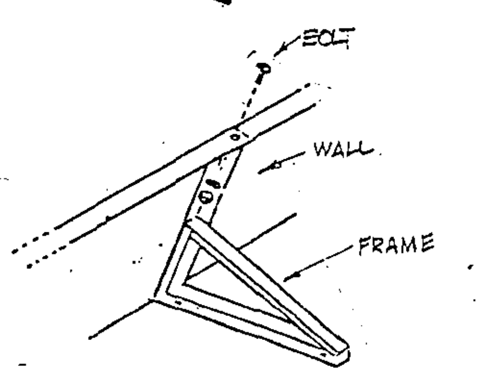
4. ATTACH CABLES TO FRAMES ALONG ONE LONG BY SLIPPING CABLE LOOPS OVER POSTS ON BOTTOMS OF FRAMES (ONE CABLE PER FRAME). STRETCH CABLES DIRECTLY ACROSS TANK. THEY WILL BE ATTACHED FOR FRAMES ON OPPOSITE WALL IN A LATER STEP.



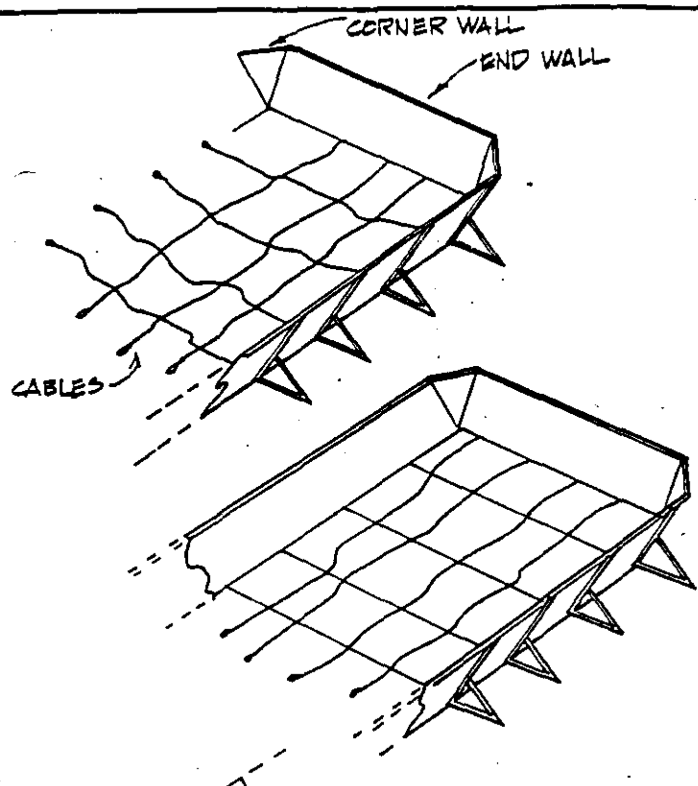
5. STARTING AT ONE CORNER, NEAREST THE GATES, STAND 2 ADJACENT WALL PANELS ON WIDE "FOOT". LINE UP BENDS ON WALL PANELS WITH CHALK LINES. LINE UP HOLES IN WALL PANELS WITH HOLE IN SUPPORT FRAME AND BOLT TOGETHER. HAND TIGHTEN ONLY. BOLT HEADS MUST BE ON INSIDE OF SPILGARD.



6. BOLT CORNER WALL PANEL TO END OF COMPLETED LONG WALL. PANEL FITS BETWEEN FRAME AND WALL. IT IS NECESSARY TO REMOVE THE BOLT IN ORDER TO INSERT THE CORNER PANEL.



7. BOLT TOP FLANGE ON WALL PANELS TO TOPS OF FRAMES.



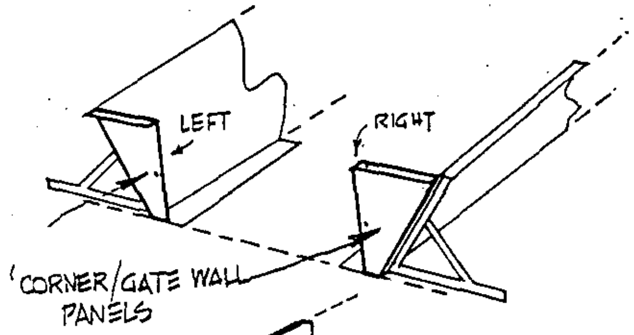
8. ASSEMBLE END WALL AS IN PREVIOUS STEPS KEEP WALLS SQUARE. MAKE SURE BEND ON WALL PANEL LINES UP WITH CHALK LINE.

9. ATTACH FREE END OF SHORT CABLES TO FRAMES THAT ARE DIRECTLY OPPOSITE EACH OTHER.

10. ATTACH REMAINING LONG WALL AS ABOVE STEPS.

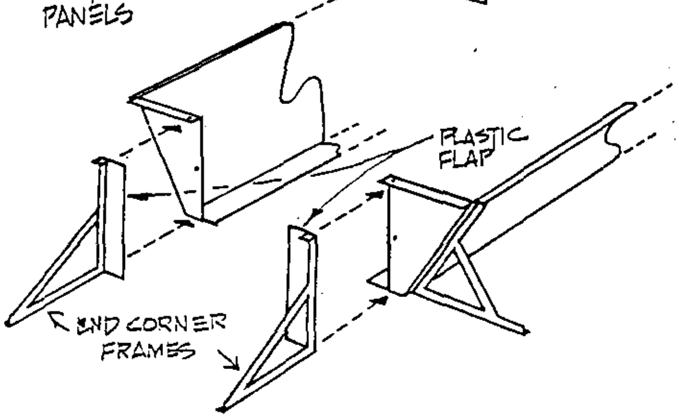
11. SQUARE-UP TANK

12. ATTACH LEFT & RIGHT CORNER/GATE WALL PANELS. REMOVE BOLT HOLDING END FRAME TO WALL. SLIP FLANGE ON CORNER/GATE WALL PANEL BETWEEN FRAME & WALL. REPLACE BOLT.



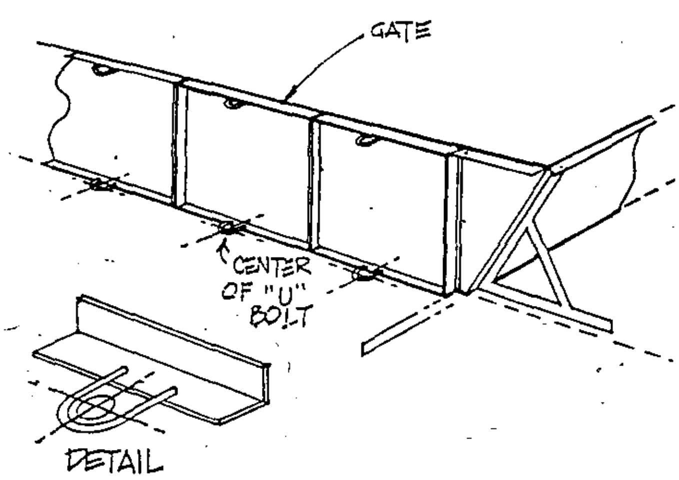
13. IF CORNER/GATE WALL PANELS DO NOT LINE UP WITH CHALK LINE, DRAW A NEW CHALK LINE THE OUTSIDE FACES OF BOTH LEFT & RIGHT PANELS.

14. ATTACH END CORNER FRAMES TO CORNER/GATE WALL PANELS WITH 2 BOLTS. BOLT HEADS MUST BE ON INSIDE OF TANK.
NOTE: THERE IS A LEFT & RIGHT FRAME, THE PLASTIC FLAPS ON EACH FRAME FACE TOWARD THE OPENING.

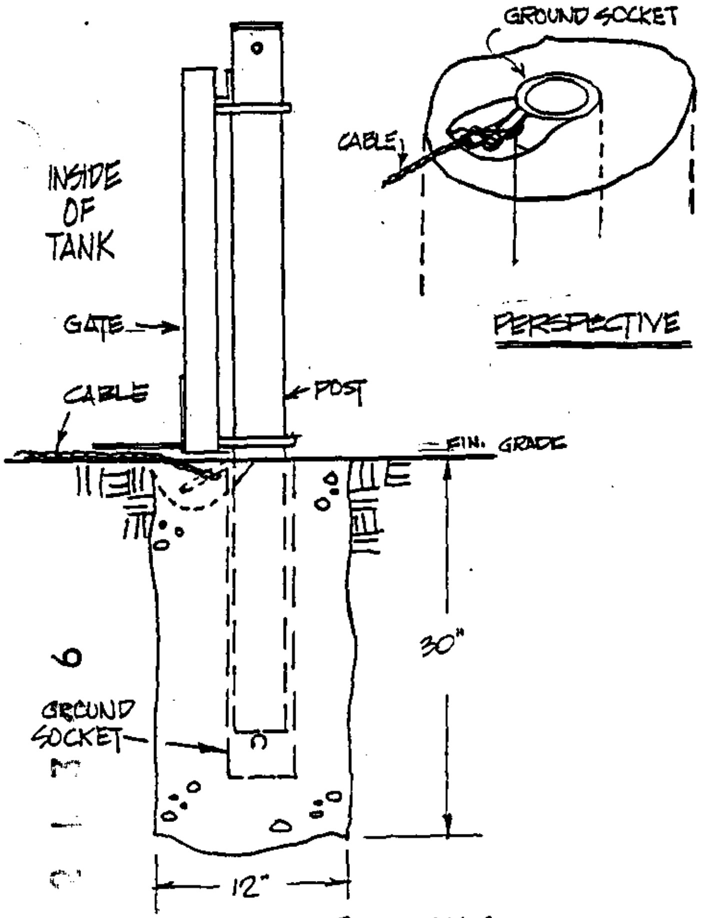


15. STAND BOTH GATES ON BOTTOM EDGES. THE TOP EDGE OF EACH GATE HAS 4 "U" SHAPED RECEPTICLES. THE BOTTOM PLASTIC FLAPS SHOULD BE ON THE INSIDE OF THE SPILGARD. OUTSIDE OF LEFT & RIGHT GATES SHOULD BE TOUCHING PLASTIC FLAPS ON LEFT & RIGHT FRAMES. MAKE SURE THE VERTICAL STEEL WALL PANEL ON THE INSIDE OF EACH GATE IS LINED UP WITH THE CHALK LINE, NOT THE PLASTIC BOTTOM FLAPS.

NOTE: THE SPACES BETWEEN WALL PANELS AND THE GATES SHOULD BE APPROXIMATELY EQUAL.



16. MARK CENTERS OF "U" BOLTS ON THE GROUND. THERE ARE 2 ON THE BOTTOM OF EACH GATE.



SECT. THRU FOOTING

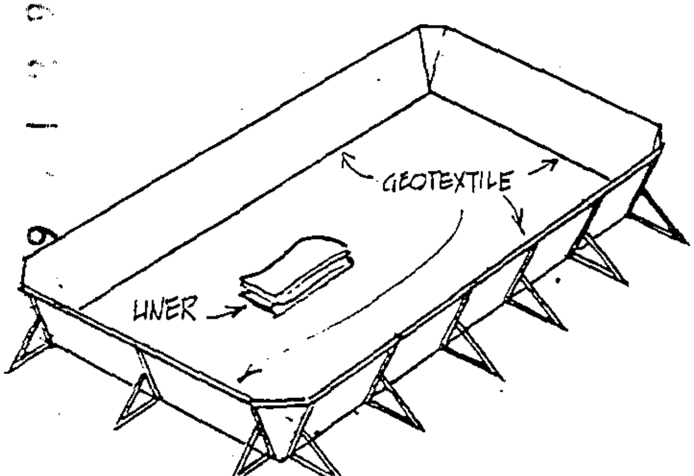
17. MOVE GATES OUT OF THE WAY AND DIG 12" DIA. HOLES 30" DEEP. HOLES SHOULD BE DUG ON THE "U" BOLT CENTERS AS IN STEP 17.

18. PLACE A GROUND SOCKET IN EACH HOLE.

19. REPLACE GATES. LINE UP WITH CHALK LINE AS IN PREVIOUS STEPS.

20. SLIP POSTS THROUGH "U" BOLTS AND INTO GROUND SOCKETS. PROP GROUND SOCKETS FLUSH WITH FINISHED GRADE.
NOTE: ANGLED CABLE POST MUST BE ON INSIDE OF TANK FACING OPPOSITE SIDE OF TANK.

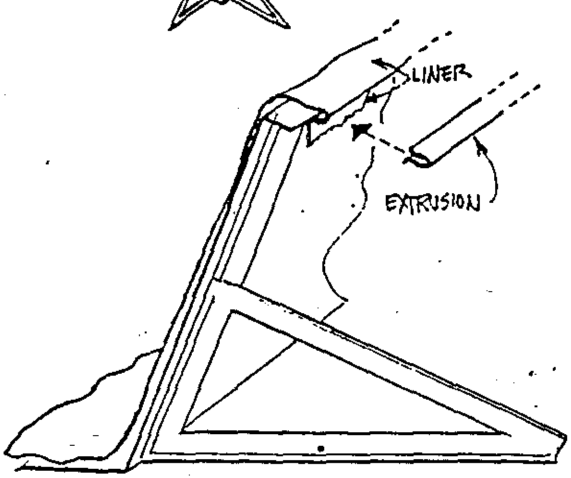
21. POUR CONCRETE INTO FOOTING HOLE UP TO FINISHED GRADE. DO NOT ALLOW CONCRETE TO ENTER GROUND SOCKET
NOTE: SCOOP CONCRETE AWAY FROM FRONT AND BOTTOM OF POST ALLOWING 1" OF CLEARENCE. THIS SPACE ALLOWS CABLE ATTACHMENT.



22. ATTACH LONG CABLES TO GROUND SOCKETS AND END SUPPORT FRAMES

23. COVER ENTIRE BOTTOM OF TANK WITH GEOTEXTILE.

24. PLACE LINER IN TANK AND UNFOLD TOWARD THE 4 WALLS, MAKE SURE LINER IS CENTERED IN TANK. FLOP EXCESS MATERIAL EVENLY OVER THE WALLS. MAKE SURE LINER COVERS ENTIRE BOTTOM AND FITS SNUGLY INTO BOTTOM "FOLD" ON WALL PANELS AND INTO THE CORNERS.



25. FOLD LINER UNDER THE LIP ON THE 2 LONG AND 1 END WALL PANELS. PUSH "U" SHAPED PLASTIC EXTRUSIONS OVER LINER/WALLS.

Pump Units™

**Pump unit includes: 1725 RPM, 115/230 volt, 60 Hz, single phase, drip proof, NEMA type I motor; pre-piped ancillary assembly (1" piping) incorporating back pressure valve, pulse damper, calibration chamber, ball valve; main connection; spare parts kit; steel mounting table.
Note: Any Pump Unit can be used with any model Tank.

Model	No. of Heads	Capacity (GPH) Min.	Max.	Approx. Shipping Wt. (lbs.)	Price
WT 113	Single	0.5	20.8	125	$3,070
WT 114	Single	0.64	34.5	125	3,140
WT 124	Dual	1.28	69.0	140	3,745

Model	No. of Heads	Capacity (GPH) Min.	Max.	Approx. Shipping Wt. (lbs.)	Price
WT 115	Single	1.9	104.1	125	$3,390
WT 125	Dual	3.8	208.2	140	4,215

ChemStor™

Tank includes fitted chemical resistant reinforced XR-5 membrane liner; steel cover; stainless steel access hatch; 3" chemical resistant inlet and outlet fittings. Sightglass optional*. All steel surfaces are epoxy coated.

Model	Interior Dim. 6'-3" H.	Capacity (Gals.)	Shipping Weight (lbs. est.)	Shipping Volume Cu. Ft. (est.)	Price
CH 202	7'-0"x7'-0"	2000	1800	50'	$5,685
CH 204	7'-0"x14'-0"	4000	3000	80'	8,640
CH 304	10'-6"x14'-0"	6000	3500	95'	9,925

Model	Interior Dim. 6'-3" H.	Capacity (Gals.)	Shipping Weight (lbs. est.)	Shipping Volume Cu. Ft. (est.)	Price
CH 404	14'-0"x14'-0"	8000	4000	110'	$11,57C
CH 405	14'-0"x17'-6"	10,000	4600	115'	12,88C

*Sightglass $200.00

OTHER SIZES AVAILABLE UPON REQUE

ComPakt™

All ComPakt tanks are composed of mil. galvinized sheet steel, hot dip galvanized angles and 20 mil. PVC, 36 mil. reinforced Hypalon or 30 mil. XR-5 liners.

Model	Interior Dim. x 4'-0" H.	Gallons	Shipping Weight Lbs.	Galv. Steel Cover	With 20 Mil. PVC	With Hypalon or XR-5 Liner
CP 0303	3'-0"x3'-0"	250	230	120	$625	$ 805
CP 0040	4'-0"x4'-0"	480	350	140	795	1,005
CP 0505	5'-0"x5'-0"	750	390	155	980	1,260

Model	Interior Dim. x 4'-0" H.	Gallons	Shipping Weight Lbs.	Galv. Steel Cover	With 20 Mil. PVC	With Hypal or XI Line
CP 0606	6'-0"x6'-0"	1000	450	250	$1,210	$1,550
CP 6.5-6.5	6'-6"x6'-6"	1250	520	275	1,370	1,720
CP 0707	7'-0"x7'-0"	1500	590	325	1,580	1,945

OTHER SIZES AVAILABLE UPON REQUE

SpilGard™

2' high modular galvanized steel secondary containment for tanker trucks. Comes with gate(s), XR-5 Liner, geotextile underlayment and geotextile liner protection layer.

Model	Capacity Gallons	Inside Dimensions x 8' High	Shipping Weight (lbs. est.)	Price
SG 0308	5,000	11'-9"x30'-6"	1490	$3,060
SG 0313	7,500	11'-9"x49'-3"	1900	3,945
SG 0326	15,000	11'-9"x98'-0"	3000	6,980

Model	Capacity Gallons	Inside Dimensions x 8' High	Shipping Weight (lbs. est.)	Price
SG 0613	15,000	23'-0"x49'-3"	2500	$ 5,935
SG 1313	32,000	49'-3"x49'-3"	3900	10,480

QuikStor™

QuikStor tanks are composed of galvanized steel components, fitted 20 mil. PVC liner, Geotextile underlay, liner clamps, and all fasteners. Potable water grade liners are available.

Model	4' H. x Dia. (ft.)	Volume (gal.)	Shipping Wt. (lbs.)	Complete Tank	HDPE Top Cover	PVC Rplcmt. Liner
Q 804	8'	1400	180	$ 625	$ 50	$215
Q 1004	10'	2200	275	780	55	250
Q 1204	12'	3100	330	955	65	275
Q 1404	14'	4300	385	1150	80	330
Q 1604	16'	5600	440	1355	95	390
Q 1804	18'	7000	500	1495	110	435
Q 2004	20'	8800	560	1695	125	485
Q 2204	22'	10600	615	1915	140	530
Q 2404	24'	12600	675	2140	155	610

Model	4' H. x Dia. (ft.)	Volume (gal.)	Shipping Wt. (lbs.)	Complete Tank	HDPE Top Cover	PVC Rplcmt Liner
Q 2604	26'	14800	735	$2340	$185	$ 685
Q 2804	28'	17000	795	2580	220	765
Q 3004	30'	19800	860	2830	250	830
Q 3204	32'	22500	920	3085	290	9
Q 3404	34'	25000	980	3355	330	1050
Q 3604	36'	28500	1045	3625	375	1185
Q 3804	38'	31700	1110	3910	425	1335
Q 4004	40'	35000	1175	4215	475	1495

TECHNICAL DATA and SPECIFICATIONS for

XR-5®

Chemical, Oil and High Temperature Resistant Geomembrane

Seaman Corporation

INDUSTRIAL FABRIC DIVISION
1000 Venture Blvd.
Wooster, Ohio 44691
(216) 262-1111

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SEAMAN CORPORATION XR-5®
CHEMICALLY RESISTANT
GEOMEMBRANE

PRODUCT FEATURES

1. **COMPOSITE DESIGN —**
   High strength from polyester base fabric, environmental and chemical resistance from Ethylene Interpolymer Alloy (EIA) coating
2. **HEAT RESISTANCE —**
   Has contained salt water up to 100°C for years
3. **CHEMICAL RESISTANCE —**
   EIA coating provides wide range of compatibility including acids, oils, and methane
4. **HEAT WELDABLE —**
   Thermal weldable for seams as strong as the membrane. Factory panels over 15,000 square feet for less field seaming
5. **STABILITY —**
   Low thermal expansion-contraction properties

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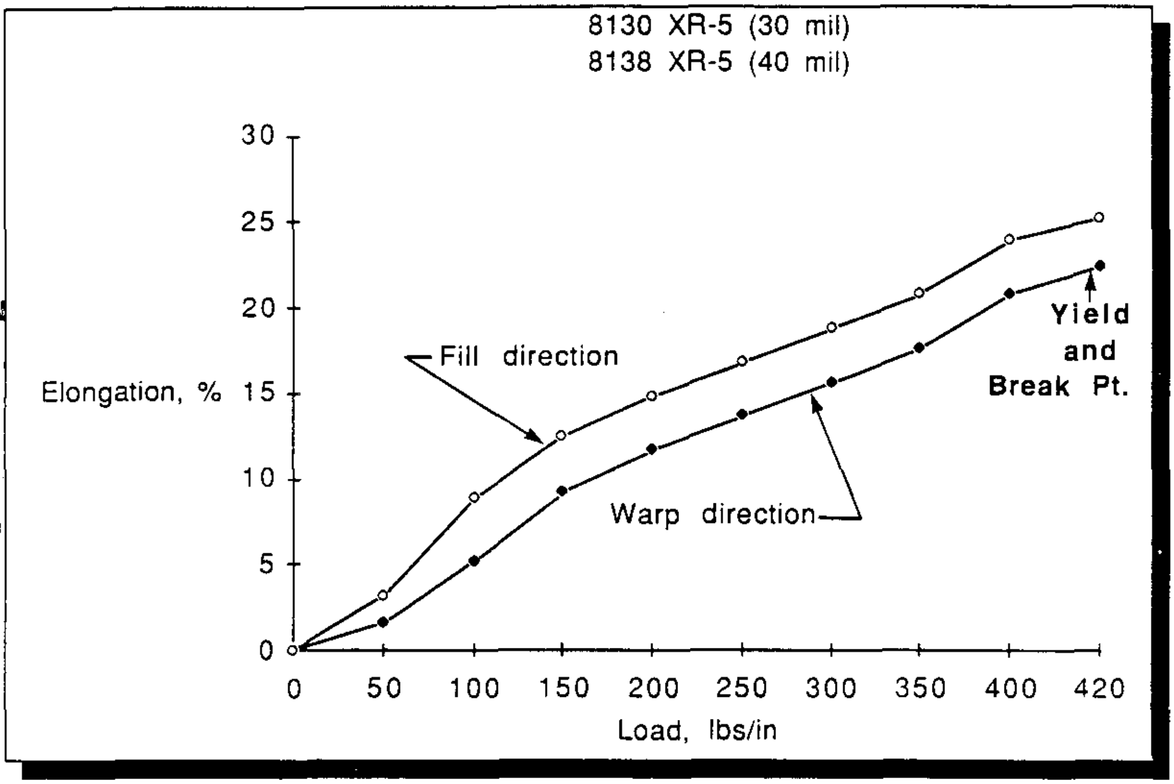
CONTENTS

SECTION A - PHYSICAL PROPERTIES

PART A-1: MATERIAL SPECIFICATIONS

8130 XR-5 : Property	Test Method	Requirement
1. Thickness	ASTM 751	30±2 mill (8130) 0.030 to 0.034 in. 40± 2 mill (8138)
2. Weight	ASTM D-751	30.0± 2 oz./sq. yd. (8130) 38.0± 2 oz./sq. yd. (8138)
3. Tear Strength	ASTM D-751	125 lbs./125 lbs.
4. Breaking Yield Strength	ASTM-D-751 Grab Tensile	475 lbs./425 lbs.
5. Low Temperature	ASTM-D-2136 4 hrs. — ⅛" mandrel	−30°F. No cracking
6. Dimensional Stability (each direction)	ASTM-D-1204 212°F.−1 hr.	2% max.
7. Hydrostatic Resistance	ASTM-D-751 Method A	500 psi (min.)
8. Blocking Resistance 180°F.	Method 5872 Fed. Std. 191a	#2 Rating Max.
9. Adhesion—Ply. lbs./in. of width	ASTM-D-413 2" per min.	9 lbs./in. (min.) or film tearing bond
10. Adhesion—heat sealed seam lbs./in. of width	ASTM-D-751	10 lbs./in. (min.)
11. Dead Load Seam shear strength	(Mil-T-52983E Para. 4.5.2.19 2" overlap seam	Must withstand 210 lbs./in. @ 70°F. 105 lbs./in. @ 160°F.
12. Abrasion Resistance (Taber Method)	Method 5306 Fed. Std. 191a H-18 Wheel 1000 gm. load	2000 cycles before fabric exposure 50 mg./100 cycles max. wt. loss
13. Weathering Resistance	Carbon-Arc Atlas Weather-o-meter	2,000 hrs. No appreciable changes or stiffening or cracking of coating
14. Water Absorption	ASTM-D-471 7 days	5% max. @ 70°F. 12% max. @ 212°F.
15. Wicking	Shelter-Rite procedure	⅛" max.
16. Puncture Resistance	FTMS 101B Method 2031	350 lbs.

PART A-2: ELONGATION PROPERTIES (UNIAXIAL)
STRESS VS. STRAIN 8130 and 8138 XR-5



Test Method: Method 5102, Fed. Std. 191, 12 inch/min. speed.

SECTION B — CHEMICAL/ENVIRONMENTAL RESISTANCE

PART B-1: XR-5® FLUID RESISTANCE GUIDELINES

The data below is the result of laboratory tests and is intended to serve only as a guide. No performance warranty is intended or implied. The degree of chemical attack on any material is governed by the conditions under which it is exposed. Exposure time, temperature, and size of the area of exposure usually varies considerably in application, therefore, this table is given and accepted at the user's risk. Confirmation of the validity and suitability in specific cases should be obtained.

When considering XR-5 for specific applications, it is suggested that a sample be tested in actual service before specification. Where impractical, tests should be devised which simulate actual service conditions as closely as possible.

EXPOSURE	RATING
Acetic Acid (5%)	B
Acetic Acid (50%)	C
Ammonium Phosphate	T
Ammonium Sulfate	T
Antifreeze (ethylene glycol)	A
Animal Oil	A
Aqua Regia	X
ASTM Fuel A (100% Iso-octane)	A
ASTM Oil #2 (Flash pt. 240°C)	A
ASTM Oil #3	A
Benzene	X
Calcium Chloride Solutions	T
Calcium Hydroxide	T
20% Chlorine Solution	A
Clorox	A
Conc. Ammonium Hydroxide	A
Corn Oil	A
Crude Oil	A
Diesel Fuel	A
Ethanol	A
Ethyl Acetate	C
Ethyl Alcohol	A
Fertilizer Solution	A
#2 Fuel Oil	A
#6 Fuel Oil	A
Furfural	X
Gasoline	B
Glycerin	A
Hydraulic Fluid	A
Hydrocarbon Type II (40% Aromatic)	C
Hydrochloric Acid (50%)	A
Hydrofluoric Acid (5%)	A
Hydrofluoric Acid (50%)	A
Hydrofluosilicic Acid (30%)	A
Isopropyl Alcohol	T
Ivory Soap	A
Jet A	A
JP-4 Jet Fuel	A

EXPOSURE	RATING
JP-5 Jet Fuel	A
JP-8 Jet Fuel	A
Kerosene	A
Magnesium Chloride	T
Magnesium Hydroxide	T
Methanol	A
Methyl Alcohol	A
Methyl Ethyl Ketone	X
Mineral Spirits	A
Naptha	A
Nitric Acid (5%)	B
Nitric Acid (50%)	C
Perchloroethylene	C
Phenol	X
Phenol Formaldehyde	B
Phosphoric Acid (50%)	A
Phosphoric Acid (100%)	C
Phthalate Plasticizer	C
Potassium Chloride	T
Potassium Sulphate	T
Raw Linseed Oil	A
SAE-30 Oil	A
Salt Water (25%)	B
Sea Water	A
Sodium Acetate Solutions	T
Sodium Bisulfite Solution	T
Sodium Hydroxide (60%)	A
Sodium Phosphate	T
Sulphuric Acid (50%)	A
50% Tanic Acid	A
Toluene	C
Transformer Oil	A
Turpentine	A
Urea Formaldehyde	A
UAN	A
Vegetable Oil	A
Water (200°F.)	A
Xylene	X
Zinc Chloride	T

Ratings are based on visual and physical examination of samples after removal from the test chemical after the samples of Black XR-5 were immersed for 28 days at room temperature. Results represent ability of material to retain its performance properties when in contact with the indicated chemical.

RATING KEY:
A—Fluid has little or no effect
B—Fluid has minor to moderate effect
C—Fuild has severe effect
T—No data-likely to be acceptable
X—No data-not likely to be acceptable

PART B-2: COMPARATIVE CHEMICAL RESISTANCE

The table below lists a variety of chemicals and indicates the action of each material when in contact with Black XR-5, CPE, Hypalon, Urethane, and supported PVC. Membrane samples were totally immersed in each of the chemicals for a period of 28 days at room temperature. The rating system is indicated as:

A — Fluid has little or no effect at R.T.
B — Fluid has minor to moderate effect at R.T.
C — Fluid has severe effect at R.T.

Chemical	XR-5®	Hypalon	Urethane	CPE	PVC
Kerosene	A	C	A	C	C
Diesel Fuel	A	C	A	C	C
Ohio Crude Oil	A	B	A	B	C
Hydraulic Fluid	A	C	A	B	C
Naptha	A	B	A	B	C
Conc. Ammonia Hydroxide	A	A	C	A	A
50% Acetic Acid	C	B	C	B	C
50% Phosphoric Acid	A	B	C	A	A
50% Hydrochloric Acid	A	A	C	A	A
50% Nitric Acid	C	B	C	A	C
50% Sulfuric Acid	A	C	C	C	A
60% Sodium Hydroxide	A	A	C	B	C
Methyl Alcohol	A	A	A	A	C
JP-4 Jet Fuel	A	B	A	B	C
Salt Water 180°F	A	B	B	B	C
Phthalate Plasticizers	B	C	A	C	C
SAE-30 Oil	A	A	A	A	C
Raw Linseed Oil	A	A	A	A	C

All technical information published in the brochure refers to the Black XR-5; other colors may not have the same chemical resistance as the black. If a color other than black is required, we suggest you check with Seaman Corporation as to the compatability and resistance to that particular chemical environment.

The above ratings were arrived at by visual and physical examination of the membrane samples after their removal from the test chemical. When considering XR-5® for specific application, it is important to study the requirements such as permeability, service temperature, concentration, size to be contained, etc. Sample of XR-5® should be tested close to actual service conditions and also Seaman Corporation should be consulted.

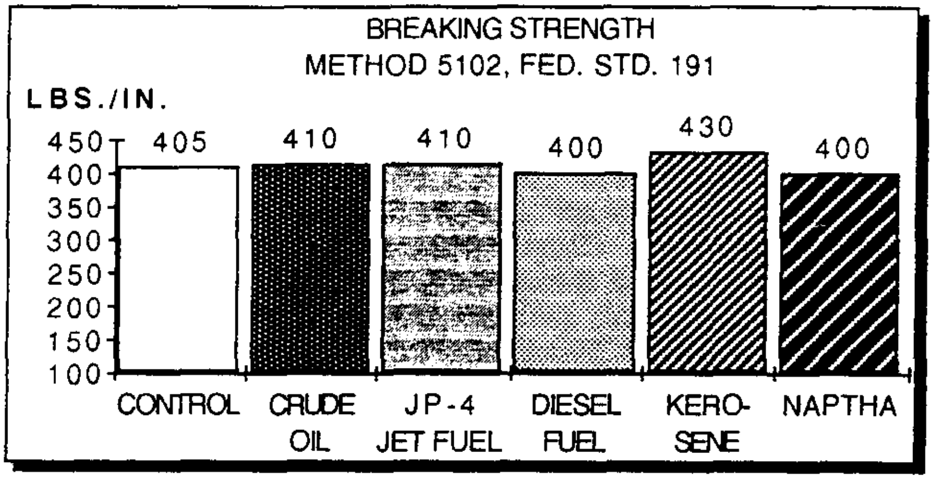
FUEL COMPATIBILITY — LONG TERM IMMERSION

TEST: Samples of 8130 XR® DC-7 Black were immersed in Diesel Fuel, JP-4 Jet Fuel, Crude Oil, Kerosene, and Naptha for 6½ years.

The samples were then taken out of the test chemicals, blotted and dried for 24 hours. The samples were observed for blistering, swelling, stiffening, cracking or delamination of the coating to the fiber.

RESULTS: It was found in all cases the 8130 XR-5®, after immersion for six years, maintained the strength and there was no evidence of blistering, swelling, stiffening, cracking or delamination.

The strip tensile strength or breaking strength of the samples was measured after six years of immersion and the following are the results.



LONG TERM SEAM ADHESION

11 YEARS IMMERSION
METHOD 5970 OF FEDERAL TEST METHOD STANDARD NO. 191
LBS./IN.

Seam samples of 8130 XR-5® were dielectrically welded together and totally immersed in the liquids for 11 years. The samples were taken out, dried for 24 hours and visually observed for any signs of swelling, cracking, stiffening or degradation of the coating. The coating showed no appreciable degradation and no stiffening, swelling, cracking or peeling.

The adhesion, or resistance to separation of the coating from the base cloth, was then measured by Method 5970 of Federal Test Method Standard No. 191. Results show 8130 XR-5® has maintained the seam strength over the long period.

	Control	Crude Oil	JP-4 Jet Fuel	Diesel Fuel	Kerosene	Naptha
8130 XR-5® DC-7 Black Lbs./in.	20+	18	33	25	40	33*

* The naptha sample was sticky.

IMMERSION: January, 1979 to March, 1990

We believe this information is the best currently available on the subject. It is offered as a possible helpful suggestion in experimentation you may care to undertake along these lines. It is subject to revision as additional knowledge and experience are gained. We make no guarantee of results and assume no obligation or liability whatsoever in connection with this information.

PART B-3: COMPARATIVE CHEMICAL PERMEABILITY DATA

Tested According to ASTM D814-55 Inverted Cup Method

Perhaps a more meaningful test is determination of the permeability or diffusion rate of the liquid chemical through the membrane. The permeability of Style 8130 XR-5, 30 Mil Hypalon laminate, and 30 Mil CPE laminate to various chemicals was determined by the ASTM D814-55 inverted cup method. All tests were run at room temperature and results are shown in the table.

Chemical	8130 XR-5 Black	30 Mil Hypalon Laminate	30 Mil CPE Laminate
	Fl. oz./ft.^{2}/24 hours	Fl. oz./ft.^{2}/24 hours	Fl. oz./ft.^{2}/24 hours
Water	0.0086	0.0079	0.034
#2 Diesel Fuel	0.0029		
Jet A	0.0104		
Kerosene	0.0134	0.147	0.223
Hi-Test Gas	0.184	1.51	2.280
Ohio Crude Oil	0.003	0.014	0.010
Low-Test Gas	0.523	—	—
Raw Linseed Oil	0.001	0.006	0.008
Ethyl Alcohol	0.021	0.073	—
Naphtha	0.0369	0.376	0.096
Perchloroethylene	1.797	—	—
Hydraulic Fluid	0.0006	0.009	1.110
100% Phosphoric Acid	0.320	Not available	Not available
50% Phosphoric Acid	0.023	Not available	Not available
Ethanol (ASTM E-96)	0.06		

Part B-4: SEAM STRENGTH

Style 8130 XR-5 Black Seam Strength After Immersion

Two pieces of Style 8130 were heat sealed together (seam width 1 inch overlap) and formed into a bag. Various oils and chemicals were placed in the bags so that the seam area was entirely covered. After 28 days at R.T., the chemicals were removed and one inch strips were cut across the seam and the breaking strengths immediately determined. Results are listed below.

Chemical	Seam Strength
None	340 lbs. fabric break—No Seam Failure
Kerosene	355 lbs. fabric break—No Seam Failure
Ohio Crude Oil	320 lbs. fabric break—No Seam Failure
Hydraulic Fluid	385 lbs. fabric break—No Seam Failure
Toluol	0 lbs. adhesion failure
Naphtha	380 lbs. fabric break—No Seam Failure
Perchloroethylene	390 lbs. fabric break—No Seam Failure

Even though 1-inch overlap seam is used in the tests to study the accelerated effects, it is recommended that XR-5 be used with a 2-inch nominal overlap seams in actual application. In some cases where temperatures exceed 160°F and application demands extremely high seam load it may be necessary to use a wider width seam.

PART B-5: SOIL BURIAL RESISTANCE

30 DAY SOIL BURIAL TEST

The samples were weighed, then placed on a 4-inch bed of active, compacted soil and covered with a 1-inch layer, of loosely packed soil. After 30 days in a chamber maintained at 85°F. to 90°F., and 90% relative humidity, the samples were recovered, rinsed with water, air dried and reweighed for % weight loss determination.

	30 Day Soil Burial			
	Weight (gms)			
Sample	Before Soil Burial	After 30 days Soil Burial	Weight Loss (gms)	% Weight Loss
8130 XR-5 DC-7 Black	39.50	39.40	0.1	0.25

8 MONTHS SOIL BURIAL

Samples of 8130 XR-5® DC-7 Black were actually buried in Sarasota, Florida soil. After 8 months the sampes were removed and returned to our laboratory for testing. Visual examination of the exposed samples showed no evidence of cracking, blistering, swelling or delamination.

Trapezoidal tear and strip tensile strength was measured to determine the effect of soil burial on the physical properties. The results show the fabric has maintained the physical integrity.

Sample	Trapezoid Tear ASTM D-2263				Strip Tensile ASTM D-751			
	Original		Exposed		Original		Exposed	
	Warp	Fill	Warp	Fill	Warp	Fill	Warp	Fill
8130 XR-5® DC-7 Black	56	66	52	56	400	400	360	440
	54	68	58	56	400	390	410	380
	55	67	55	56	400	395	385	410
	Values in lbs.				Values in lbs./in.			

PART B-6: WEATHERING RESISTANCE

ACCELERATED WEATHERING TEST

XR-5 has been tested in the carbon arc weatherometer for over 10,000 hours of exposure. The sample showed no loss in flexibility and no significant color change. Based on field experience of Seaman Corporation products and similar weatherometer exposure tests, XR-5 should have an outdoor weathering life significantly longer than competitive geomembranes, particularly in tropical or subtropical applications.

EMMAQUA Testing: ASTM E-838-81 was performed on a modified form of XR-5, FiberTite, used in the single-ply roofing industry. After 3 million Langleys in Arizona, no signs of degradation were noted with no evidence of cracking, blistering, swelling or adhesion failure of the coating.

PART B-7: COMPARATIVE HIGH TEMPERATURE PERFORMANCE

The results listed below are laboratory results only and are presented to indicate which liner material will provide the best performance in high temperature immersion applications. They are comparative results only, conducted under controlled laboratory conditions and are not intended to represent actual field performance. The tests are designed to identify the material with the best performance properties when exposed to these types of conditions.

1. WATER IMMERSION TEST

2-inch x 2-inch squares of the liner material were immersed in water at 180°F for 14 days. The samples were weighed before and after immersion to determine weight change. Visual observations were made to detect any adverse affect on material. The following results were noted:

Water Immersion—180°F for 14 days

Material	% Weight Gain	Observation
8430 XR-5 Black	+ 10.8%	No significant visible change.
Hypalon Reinforced 10 x 10	+ 22.1%	Slight dimension change and wicking evidence.
CPE Reinforced 10 x 10—Black	+102.2%	Swelling, blistering, wicking, and dimension change readily visible.
CPE Reinforced 10 x 10—Gray	+ 63.8%	Swelling, blistering, wicking, and dimension change readily visible.

Water Immersion—212°F for 7 days

Material	% Weight Gain	Observation
8130 XR-5 Black	+ 9.9%	No significant visible change.
Hypalon Laminate	+85.8%	Swelling, wicking, and dimensional change readily visible.
CPE Laminate	+38.8%	Wicking, slight swelling, and dimensional change.

2. HIGH TEMPERATURE BLOCKING

Federal Standard No. 191, Method 5872

Samples of material were folded into 4-inch x 4-inch squares, placed in an oven at 180°F for 1 hour with a 4 lb. weight placed on top. The purpose of the test is to determine the handling properties of the material at high temperatures. The following results were noted:

Material	Result
8430 XR-5 Black	No effect.
Hypalon Reinforced 10 x 10	Material sticks together, impossible to separate.
CPE Reinforced 10 x 10	Material sticks together, impossible to separate.

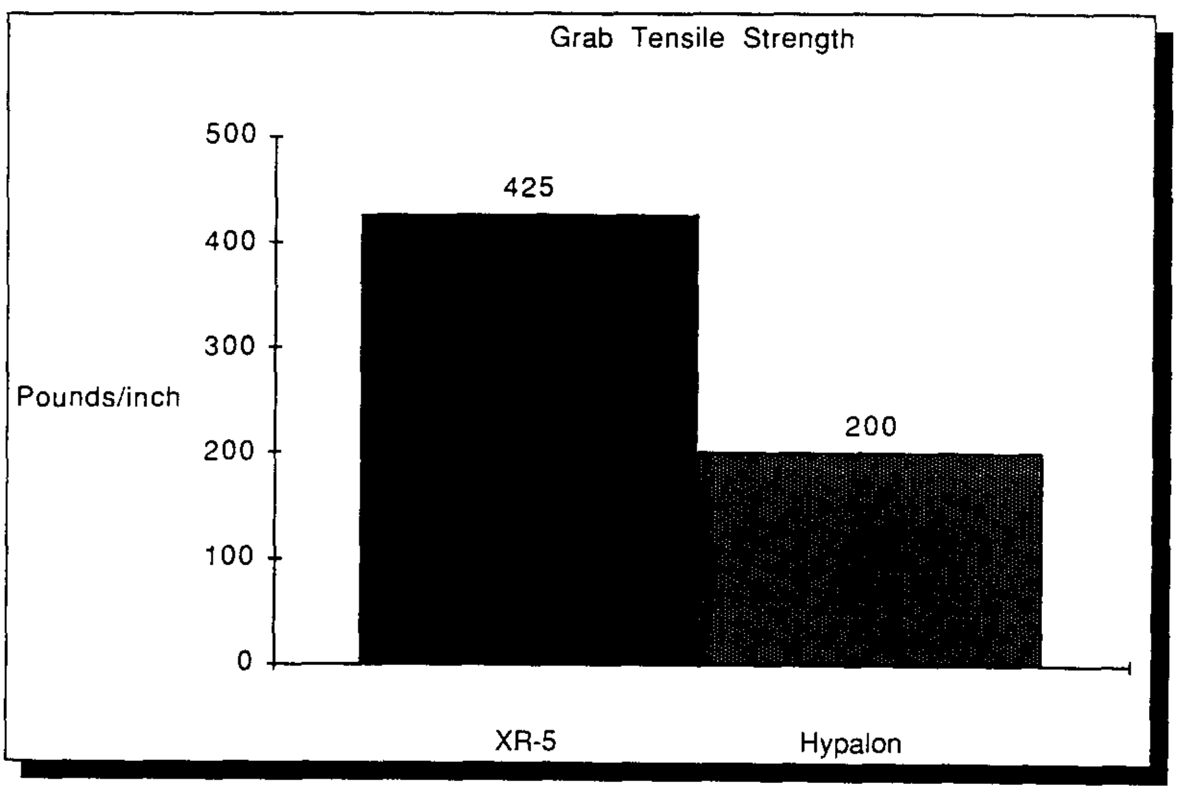
PART B-8: XR-5/HYPALON TENSILE STRENGTH

1. PHYSICAL STRENGTH

Test specimens of materials were cut and tested to the indicated standards. Similar specimens were then immersed in water at 180°F for 14 days and tested again to determine if there was any significant change in physical properties. The following results were noted:

Method	Strip Tensile—Method 5102		Trapezoid Tear—Method 5136		Hydrostatic Resistance —Method 5512	
	Original (lbs./in.)	Exposed (lbs./in.)	Original (lbs.)	Exposed (lbs.)	Original	Exposed
8430 XR-5 Black	350 x 385	335 x 340	48 x 62	78 x 62	600 psi	600 psi
Hypalon Reinforced 10 x 10	195 x 172	117 x 127	85 x 137	80 x 74	470 psi	305 psi
CPE Reinforced 10 x 10	165 x 138	Sample deteriorated unable to test	63 x 68	Sample deteriorated unable to test	390 psi	Sample deteriorated unable to test

GRAB TENSILE STRENGTH—XR-5 VS. HYPALON



Test Method: ASTM D-751 Grab Method

2. ADHESION AND BONDED SEAM STRENGTH

Samples of typical seams were constructed and immersed in water at 160°F for 10 days to determine the high temperature moisture affect on seam strength performance. The following results were noted:

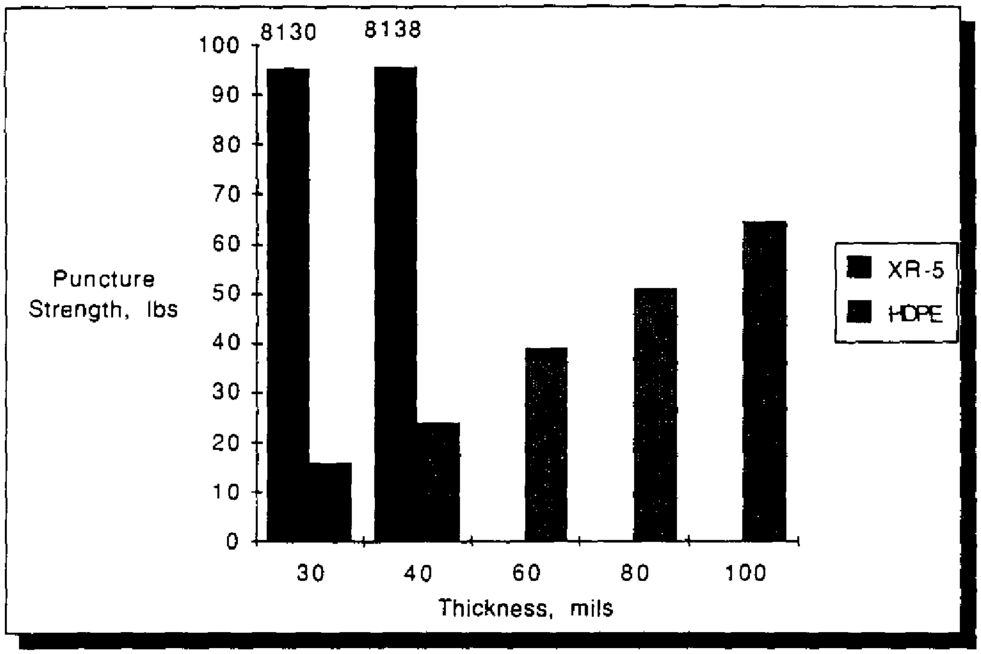
Material	Peel Adhesion— Method 5970		Bonded Seam Strength— ASTM D 751	
	Original	Exposed	Original	Exposed
8430 XR-5 Black Electronic Weld	20 + lbs./inch	20 + lbs./inch	378 lbs.	352 lbs.
Cemented	Not Recommended		Not Recommended	
Hypalon Reinforced 10 x 10 Electronic Weld	20 + lbs./inch	7 lbs./inch	298 lbs.	270 lbs.
Cemented	20 + lbs./inch	7 lbs./inch	297 lbs.	263 lbs.
CPE Reinforced 10 x 10 Electronic Weld	20 + lbs./inch	12 lbs./inch	305 lbs.	290 lbs.
Cemented	20 + lbs./inch	2 lbs./inch	312 lbs.	90 lbs.

We believe this information is the best currently available on the subject. It is offered as a possible helpful suggestion in experimentation you may care to undertake along these lines. It is subject to revision as additional knowledge and experience are gained. We make no guarantee of results and assume no obligation or liability whatsoever in connection with this information.

SECTION C — XR-5/HDPE COMPARATIVE PROPERTIES

PART C-1: PUNCTURE RESISTANCE

1. FTMS 191, Method 5120 (Room Temperature)
PUNCTURE RESISTANCE, XR-5 VS. HDPE



Test Method: FTMS 191, Method 5120; Screwdriver tip (0.312" x 0.031"), 45 degree angle

2. FTMS Method 2065 (Room Temperature)*

	8130 XR-5	Polyflex HDPE		Gundle Lining HD	
Thickness, mils	33	40	60	60	80
Force, lbs.	168	66	85	85	—
Elongation, inches	0.44	0.67	0.27	0.26	—

3. FTMS Method 2065 (70°C)*

	8130 XR-5	Polyflex HDPE		Gundle Lining HD	
Thickness, mils	33	40	60	60	80
Force, lbs.	109	32	45	46	—
Elongation, inches	0.65	0.25	0.27	0.26	—

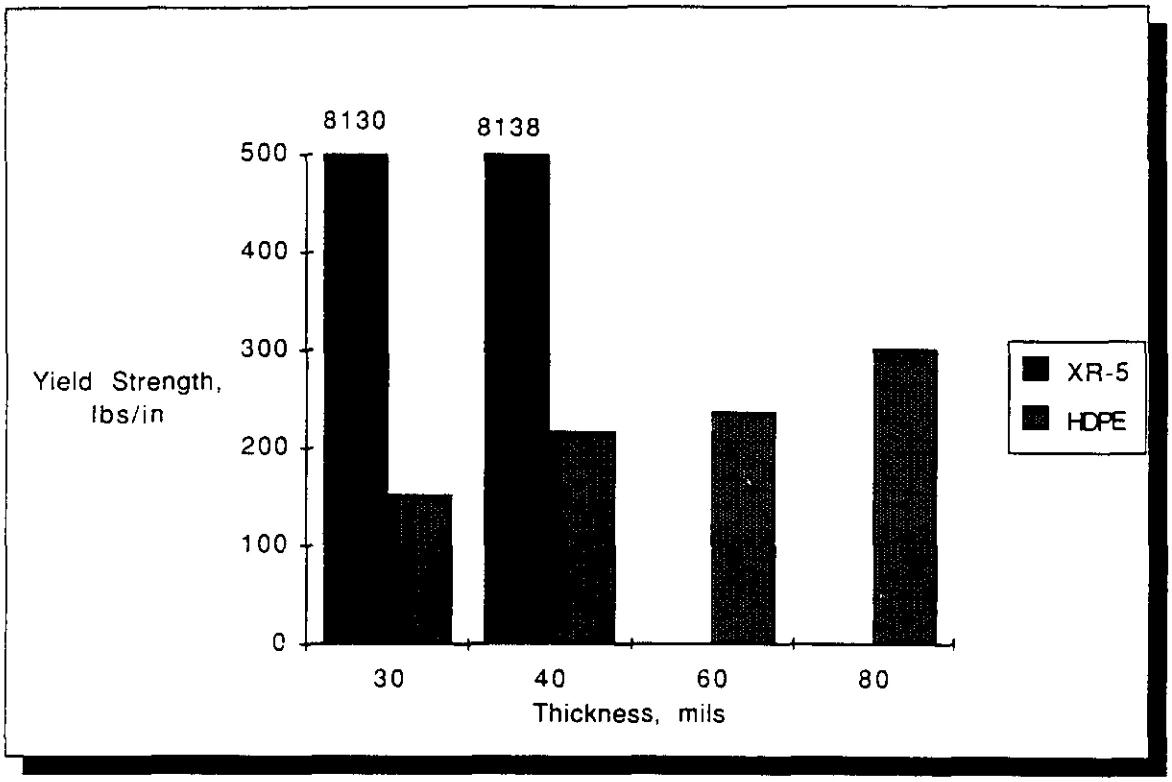
4. FTMS Method 2065 (100°C)*

	8130 XR-5	Polyflex HDPE		Gundle Lining HD	
Thickness, mils	33	40	60	60	80
Force, lbs.	92	24	27	34	—
Elongation, inches	0.49	0.58	0.34	0.35	—

*Data provided by E.I. DuPont de Nemours & Co., Wilmington, Delaware

PART C-2: YIELD STRENGTH

YIELD STRENGTH, XR-5 VS. HDPE



Test Method: Grab Tensile, ASTM D751, 70 Deg. C

'Data provided by E.I. DuPont de Nemours & Co., Wilmington, Delaware

2. **Strip Tensile, ASTM D751, Room Temperature***

	8130 XR-5	Polyflex HDPE		Gundle Lining HD	
Thickness, mils	33	40	60	60	80
Yield Strength lbs./in.	280	120	150	145	167
Yield Elongation, %	20	20	20	20	45

3. **Strip Tensile, ASTM D751, 70°C***

	8130 XR-5	Polyflex HDPE		Gundle Lining HD	
Thickness, mils	33	40	60	60	80
Yield Strength, lbs./in.	200	66	90	88	127
Yield Elongation, %	20	20	18	18	15

PART C-3: TEAR STRENGTH

1. **Tongue Tear (8" x 8" Specimens), ASTM D751, Room Temperature***

	8130 XR-5	Polyflex HDPE
Thickness, mils	33	60
Tear Strength, lbs.	230	130

*Data provided by E.I. DuPont de Nemours & Co., Wilmington, Delaware

2. Tongue Tear (8" x 8" Specimens), ASTM D751, 70°C*

	8130 XR-5	Polyflex HDPE
Thickness, mils	33	60
Tear Strength, lbs.	160	105

3. Graves Tear, ASTM D624, Die C, Room Temperature*

	8130 XR-5	Polyflex HDPE		Gundle Lining HD	
Thickness, mils	33	60	80	60	80
Tear Strength, lbs.	940	533	538	577	880

4. Graves Tear, ASTM D624, Die C, 70°C*

	8130 XR-5	Gundle Lining HD
Thickness, mils	33	80
Tear Strength, lbs.	700	575

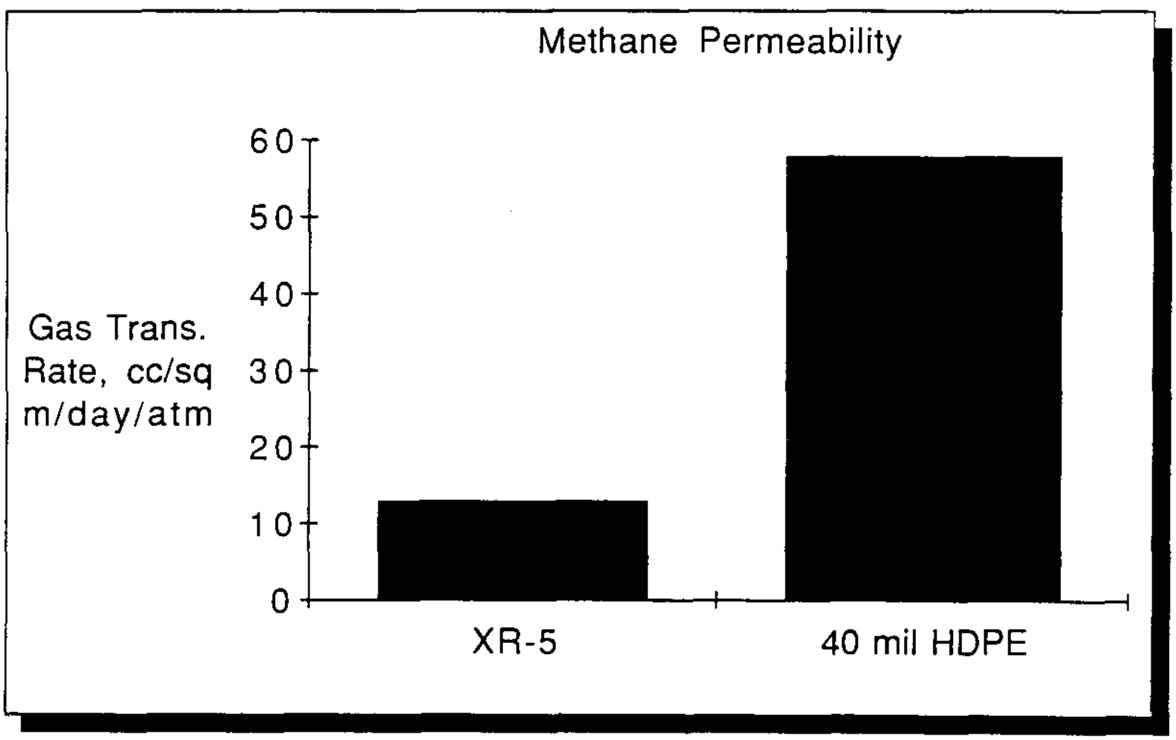
*Data provided by E.I. DuPont de Nemours & Co., Wilmington, Delaware

PART C-4: METHANE PERMEABILITY*

Test: ASTM D1434, Methane Gas Transmission Rate

	8130 XR-5	HDPE
Thickness, mils	33	40
Gas Transmission Rate, cc/m²/day/atm	13	58

METHANE PERMEABILITY - XR-5 vs. HDPE



*Data provided by E.I. DuPont de Nemours & Co., Wilmington, Delaware

SECTION D — EXAMPLE FABRICATION/INSTALLATION SPECIFICATIONS

1.01 SCOPE OF WORK

1.02 PRODUCTS

1.03 SUBMITTALS

1.04 FACTORY FABRICATION

1.05 INSPECTION AND TESTING OF FACTORY SEAMS

1.06 CERTIFICATION AND TEST REPORTS

1.07 PANEL PACKAGING AND STORAGE

1.08 QUALIFICATIONS OF SUPPLIERS

1.09 SUBGRADE PREPARATION BY OTHERS

1.10 LINING INSTALLATION

1.11 XR-5 FIELD SEAMING

1.12 INSPECTION

1.13 PATCHING

1.14 WARRANTY

SPECIFICATION
FOR
GEOMEMBRANE LINER

GENERAL

1.01 SCOPE OF WORK

Furnish and install flexible membrane lining in the areas shown on the drawings. All work shall be done in strict accordance with the project drawings, these specifications and membrane lining fabricator's approved shop drawings.

Geomembrane panels will be supplied sufficient to cover all areas, including, appurtenances, as required in the project, and shown on the drawings. The fabricator/installer of the liner shall allow for shrinkage and wrinkling of the field panels.

1.02 PRODUCTS

The lining material shall be 8130 XR-5® as manufactured by Seaman Corporation, (1000 Venture Boulevard, Wooster, Ohio 44691; 216-262-1111), with the following physical specifications:

Base - (Type)	Polyester
Fabric - (Weight)	6.5 oz./sq. yd.
Finished Coated Weight *(ASTM D-751)*	30± 2 oz./sq. yd.
Tongue Tear *(ASTM D-751, Tongue Method) (8″x10″ Sample)*	125/125 lbs. min.
Trapezoid Tear *(ASTM D-2263)*	35/35 lbs. min.
Grab Yield Tensile *(ASTM D-751, Grab Method)*	475/425 lbs. min.
Strip Yield Tensile *(ASTM D-751, Cut Strip Method)*	400/350 lbs. min.
Elongation @ Yield (%)	20% min.
Adhesion *(ASTM D-751, Adhesion Para. b)*	10 lbs./in. min.
Hydrostatic Resistance *(ASTM D-751, Method A Proc. 1)*	500 psi min.
Puncture Resistance *(FTMS 101B, Method 2031)*	350 lbs. min.
Dead Load *(Mil-T-52983 E)* Room Temperature	210 lbs. min.
(Para. 4.5.2.19) (2″ overlap seam, 4 hours) 160°F.	105 lbs. min.
Cold Crack *(Mil-C-20696 C) (Para. 4.4.6)*	Pass @ −30°F.
Weathering Resistance *(Carbon-Arc Atlas Weather-o-meter)*	2,000 hours min. with no appreciable changes or stiffening or cracking of coating
Dimensional Stability *(ASTM D-1204, 212°F. 1 hour, each direction)*	2% Max.
Water Absorption *(ASTM D-471, 7 days)*	5% max. @ 70°F. 12% max. @ 212°F.
Abrasion Resistance *(Taber Method, Method 5306, Fed. Std. 191a, H-18 Wheel, 100g load)*	2000 cycles before fabric exposure; 50mg/100 cycles max. wgt. loss

1.03 SUBMITTALS

The fabricator of panels used in this work shall prepare shop drawings with a proposed panel layout to cover the liner area shown in the project plans. Shop drawings shall indicate the direction of factory seams and shall show panel sizes consistent with the material quantity requirements of 1.01.

Details shall be included to show the termination of the panels at the perimeter of lined areas, the methods of sealing around penetrations, and methods of anchoring.

Placement of the lining shall not commence until the shop drawings and details have been approved by the Owner, or his representative.

1.04 FACTORY FABRICATION

The individual XR-5® liner widths shall be factory fabricated into large sheets custom designed for this project so as to minimize field seaming. The number of factory seams must exceed the number of field seams by a factor of at least 10.

A two-inch overlap seam done by heat or RF welding is recommended. The surface of the welded areas must be dry and clean. Pressure must be applied to the full width of the seam on the top and bottom surface while the welded area is still in a melt-type condition. On a hot air welder, the bottom surface must be flat to insure that the entire seam is welded properly. Enough heat shall be applied in the hot air welding process that a visible bead is extruded from both edges being welded. The bead insures that the material is in a melt condition and a successful chemical bond between the two surfaces is accomplished.

2" seams must withstand a minimum of 210 pounds per inch dead load at 70°F. and 105 pounds per inch at 160°F. as outlined in Mil-T-43211 (GL) paragraph 4.4.4 (4 hours). All seams must exceed parent material in strength.

1.05 INSPECTION AND TESTING OF FACTORY SEAMS

The fabricator shall perform 100% continuous visual inspection of each linear foot of seam as it is produced. Upon discovery of any defective seam, the fabricator shall stop production of panels used in this work and shall repair the seam, and determine and rectify the cause of the defect prior to continuation of the seaming process.

The fabricator must provide a Quality Control procedure to the owner or his representative which details his method of visual inspection and periodic system checks to ensure leak-proof factory fabrication.

1.06 CERTIFICATION AND TEST REPORTS

Prior to installation of the panels, the fabricator shall provide the Owner, or his representative, with written certification that the factory seams were inspected in accordance with Section 1.05.

1.07 PANEL PACKAGING AND STORAGE

Factory fabricated panels shall be accordian-folded, or rolled, onto a sturdy wooden pallet designed to be moved by a forklift or similar equipment. Each factory fabricated panel shall be prominently and indelibly marked with the panel size. Panels shall be protected as necessary to prevent damage to the panel during shipment.

Panels which have been delivered to the project site shall be stored in a dry area.

1.08 QUALIFICATIONS OF SUPPLIERS

The fabricator of the lining shall be experienced in the installation of flexible membrane lining, and shall provide the Owner, or his representative with a list of not less than five (5) projects and not less than 500 thousand (500,000) square feet of successfully installed XR-5® synthetic lining. The project list shall show the name, address, and telephone number of an appropriate party to contact in each case.

The installer shall provide similar documentation.

1.09 SUBGRADE PREPARATION BY OTHERS

Lining installation shall not begin until a proper base has been prepared to accept the membrane lining. Base material shall be free from angular rocks, roots, grass and vegetation. Foreign materials and protrusions shall be removed, and all cracks and voids shall be filled and the surface made level, or uniformly sloping as indicated on the drawings. The prepared surface shall be free from loose earth, rocks, rubble and other foreign matter. Generally, no rock or other object larger than USCS sand (SP) should remain on the subgrade in order to provide an adequate safety factor against puncture. Geotextiles may be used to compensate for irregular subgrades. The subgrade shall be uniformly compacted to ensure against settlement. The surface on which the lining is to be placed shall be maintained in a firm, clean, dry and smooth condition during lining installation.

1.10 LINING INSTALLATION

Prior to placement of the liner, the installer will indicate in writing to the owner or his representative that he believes the subgrade to be adequately prepared for the liner placement.

The lining shall be placed over the prepared surface in such a manner as to assure minimum handling. The sheets shall be of such lengths and widths and shall be placed in such a manner as to minimize field seaming.

In areas where wind is prevalent, lining installation should be started at the upwind side of the project and proceed downwind. The leading edge of the liner shall be secured at all times with sandbags or other means sufficient to hold it down during high winds.

Sandbags or rubber tires may be used as required to hold down the lining in position during installation. Materials, equipment or other items shall not be dragged across the surface of the liner, or be allowed to slide down slopes on the lining. All parties walking or working upon the lining material shall wear soft-sole shoes.

Lining sheets shall be closely fit and sealed around inlets, outlets and other projections through the lining. Lining to concrete seals shall be made with a mechanical anchor, or as shown on the drawings. All piping, structures and other projections through the lining shall be sealed with approved sealing methods.

1.11 XR-5® FIELD SEAMING

All requirements of Sections 1.04 and 1.05 apply. A visible bead should be extruded from the hot air welding process.

Field fabrication of lining material will not be allowed.

1.12 INSPECTION

All field seams will be tested using the Air Lance Method. A compressed air source will deliver 55 psi minimum to a 3/16 inch nozzle. The nozzle will be directed to the lip of the field seam in a near perpendicular direction to the length of the field seam. The nozzle will be held 4 inches maximum from the seam and travel at a rate not to exceed 15 feet per minute. Any loose flaps of 1/8″ or greater will require repair.

All field seams should also be inspected utilizing the Vacuum Box Technique, as described in ASTM D35.1.89, Standard Practice for Seam Evaulation by Negative Pressure Method, except a pressure of 3 to 5 psi should be used. All leaks shall be repaired and tested.

All joints, on completion of the work, shall be tightly bonded. Any lining surface showing injury due to scuffing, penetration by foreign objects, or distress from rough subgrade, shall as directed by the Owner, or his representative, be replaced or covered, and sealed with an additional layer of lining of the proper size, in accordance with the patching procedure.

1.13 PATCHING

Any repairs to the lining shall be patched with the lining material. The patch material shall have rounded corners and shall extend a minimum of four inches (4″) in each direction from the damaged area.

Seam repairs or seams which are questionable should be cap stripped with a 1″ wide strip of the liner material. The requirements of Section 1.11 apply to this cap stripping.

1.14 WARRANTY

The lining material shall be warranted on a pro-rated basis for 10 years against both weathering and chemical compatability in accordance with Seaman Corporation warranty for XR-5 Style 8130. A test immersion will be performed by the owner and the samples evaluated by the manufacturer. Workmanship of installation shall be warrantied for one year on a 100% basis.

ABREPOR [redacted]

Seaman Corporation
INDUSTRIAL FABRIC DIVISION
Research and Development Dept.
1000 Venture Blvd., Wooster, OH 44691
Phone 216/262-1111

DATE: October 28, 1991

SUBJECT: Long-Term Weathering of 8130 XR-5® Geomembrane

The following collective data on 8130 XR-5® geomembrane gives a varied look at long-term weathering from artificial to natural environment.

ATLAS CARBON ARC, Method 5804, Federal Standard No. 191.
10,722 hours of continuous exposure of heat, water spray and light, using a universal cam for rubber, paint and the textile industry.

XENON Ci65 WEATHER-O-METER, ASTM D-2565.
12,000 plus hours of continuous exposure using a 6500/3500 watt Xenon burner tube with borosilicate filters with little to no effect. Continuing exposure to total failure.

NATURAL ENVIRONMENT
15 years as a pond liner in Ohio Agricultural and Research & Development Center, Wooster, Ohio. Still in service.

12 years as a holding basin at a large oil company in the Texas desert. Still in service.

10 years as a floating cover for a potato processing plant in Northern France which produces a biogas mixture of 50-55% methane. Still in service.

7-1/2 years on outdoor weather-rack in Sarasota, Florida, with little effect on fabric. 8130 XR-5® fabric has retained 100% of tensile strength.

Frank Bradenburg
Manager of Research & Development

Original: Felon Wilson/Kent Sogge
cc: file/lab/Priscilla/Ken Chaloupek

Geocomposites

TYPICAL PHYSICAL PROPERTIES OF

NONWOVEN POLYESTER GEOTEXTILES

	GT60	GT80	GT100	GT120	GT160	GT180
MASS PER Y2 ASTM D3776	6.0	8.0	10.0	12.0	16.0	18.0
THICKNESS ASTM D1777	80	100	125	150	200	220
AOS ASTM D4751	70	70	70	70	100	100
PERMITIVITY ASTM D4491	1.7	1.5	1.3	1.1	0.5	0.4
FLOW RATE ASTM D4491	170	150	140	130	110	100
PUNCTURE ASTM D4833	60	110	130	145	190	220
MULLEN BURST ASTM D3786	300	400	470	570	730	810
TRAPIZOID TEAR ASTM D4533	80	90	100	110	150	180
GRAB TENSILE	155	215	280	320	480	540
ELONGATION ASTM D4632	70	70	70	70	70	70
UV ASTM D4355	95	95	95	95	95	95

NONWOVEN NEEDLE-PUNCHED POLYESTER GEOTEXTILES ARE IDEAL FOR USE IN SEPARATING DISSIMILAR SOILS, REINFORCING SOFT SOILS AND IN FACILITATING AND CONTROLLING DRAINAGE. THEY ARE THICK, AND AVAILABLE IN THE WIDEST RANGE OF WEIGHTS IN THE INDUSTRY. THEY ARE OUTSTANDING FOR CUSHIONING AND PROTECTING GEOMEMBRANES, AND ARE EXTREMELY EFFECTIVE UNDER RIPRAP FOR EROSION CONTROL. BECAUSE THEY ARE POLYESTER, THEY OFFER UNIQUE ADVANTAGES AS A GEOTEXTILE: EXCEPTIONAL STRENGTH, EXTREMELY HIGH REISTANCE TO CREEP, CHEMICAL INERTNESS AND OUTSTANDING RESISTANCE TO ABRASION AND DEGRADING ... AND ARE VIRTUALLY UNAFFECTED BY THE SUN'S ULTRAVIOLET RAYS. NONWOVEN POLYESTER GEOTEXTILES HAVE EXCEPTIONAL FILTRATION PROPERTIES.

SEAMAN CORPORATION
KENT L. SOGGE, P.E.
GEOMEMBRANE PRODUCTS SPECIALIST
0 BELLEVUE WAY N.E., SUITE 400, BELLEVUE, WA 98004
FAX (206)462-5638 - TELEPHONE (206)462 2641

XR-5 MEMBRANE LINER APPLICATIONS
(Example List)

Seaman Corporation
Wooster, Ohio

OWNER	LOCATION	APPLICATION (Installation Year)
High Temperature Applications		
Tennessee Valley Authority	Chattanooga, TN	Solar Pond - 26% Brine at 160 deg. F. continuous (1981)
Ohio State University	Miamisburg, OH	Solar Pond (1976)
Ohio State University	Wooster, OH	Solar Pond (1976)
University of Maryland	College Park, MD	Solar Pond (1990)
Argonne National Laboratory	Illinois	Solar Pond (1982)
University of Texas	El Paso, TX	Solar Pond (1981)
APEC	Alabama	Solar Heating Storage Cells (1985)
Energy Engineering	New Mexico	Solar Heating Storage Cells (1985)
Confidential	China	Solar Pond (1985)
University of New Mexico	Albuquerque, NM	Solar Pond (1985)
Kuwait Science Institute	Kuwait	Solar Pond (1986)
Magma Power Company	Niland, CA	High Temperature Brine (1987 & 1988)
Iochem Corp.	Vici, OK	High Temperature Brine (1988)
Unocal Geothermal	Calipatria, CA	High Temperature Brine (1988)
Unocal Geothermal	East Mesa, CA	High Temperature Brine (1988)
Mobil Oil Corp.	Bakersfield, CA	High Temperature Brine (1988)
Marathon Oil	Kenai, AK	Production Water (1990)
Amoco Production	CO, WY	Brine Sumps (1989-1990)
Dow Corning	Carrollton, KY	High Temperature Brine (1991)

DATED JANUARY 1992

OWNER	LOCATION	APPLICATION (Installation Yea
U. S. Marine Corps	Cherry Point, NC	Secondary Containment for Je Fuel (1988, 1991)
U. S. Marine Corps	Yuma, AZ	Secondary Containment for Je Fuel (1988, 1991)
U. S. Marine Corps	29 Palms, CA	Secondary Containment for Je Fuel (1988, 1991)
	Crude Oil/Salt Water/Oily Water Applications	
Getty Oil Corporation	Odessa, TX	Crude Oil Holding Pits (1977
Chevron Corporation	Midland, TX	Salt Water/Crude Oil (1990)
Getty Oil Corporation	Crane, TX	Crude Oil Holding Pits (1979
Getty Oil Corporation	Dumas, TX	Crude Oil/Brine Pits (1980)
Natural Gas Pipeline Company	Dumas, TX	Oily Waste/Ethylene Glycol (1982)
AMOCO	Wyoming	Oily Wastewater (1982)
Petroleum Corp. of Delaware	Wyoming	Brine Ponds (1986)
HCL Disposal Services	Woodward, OK	Brine Pond (1985)
U. S. Bureau of Land Management	Bedrock, CO	Brine Impoundment (1986)
Apache Corp.	Bay City, TX	Crude Oil/Brine Pits (1985)
Shell Western	Laredo, TX	Crude Oil/Brine Pit (1986)
Northern Illinois Gas Company	Hudson, IL	Industrial Surface Impoundme - Brine (1984)
Basin Disposal, Inc.	Bloomfield, NM	Brine Storage Pond (1985)
ARCO Oil and Gas Company	Alaska, Wyoming, Colorado, New Mexico, Louisiana, Oklahoma, Texas, California	Crude Oil/Brine Pits (1984-Present)
Sun Oil Company	Michigan	Oily Wastewater Impoundment (1982)

OWNER	LOCATION	APPLICATION (Installation Year)
Permian Brine	Pyote, TX	Crude Oil Holding Pits (1979)
Warren Petroleum	Imperial, TX	Crude Oil Holding Pits (1980)
Merkel Salt Water Disposal, Inc.	Merkel, TX	Brine Storage Ponds (1980)
Shell Oil Company	Deer Park, TX	Brine and Acid Storage Pond (1981)
Sabanna Water Injection	Cross Plains, TX	Brine Storage Pond (1981)
Exxon Company, USA	West Yellow Creek, MS	Crude Oil Holding Pits (1981)
Exxon Company, USA	Waynesboro, MS	Crude Holding Pits (1983)
Chevron	Crane, TX	Crude Oil/Salt Water Pit (1990)
Chevron Resources	Norman Wells, N.W.T.	Drilling Fluid Containment (1987)
Kimball Production Company	Pecos, TX	High Temperature Water (1981)
Sun Exploration	Texas	Crude Oil Holding Pits (1983)
UPG, Inc.	Kansas	Salt Water Storage Impoundment (1985)
Dresser Industries	Mississippi	Crude Oil Holding Pits (1985)
Disposal Services, Inc.	Hennessey, OK	Salt Water Storage Impoundment (1984)
AMOCO Production Company	Texas	Crude Oil Holding Pits (1983)
Basin Disposal	New Mexico	Salt Water Storage Impoundment (1985)
Shell Oil	Ruth, MS	Salt Water Storage Impoundment (1989)
Exxon Company, USA	Andrews, Texas	Salt Water Storage Impoundment (1986)
Chevron	Midland, Texas	Salt Water Storage Impoundment (1989)

OWNER	LOCATION	APPLICATION (Installation Year
Exxon Company, USA	Baytown, TX	Floating Boom - Crude Oil Containment (1985)
Coal Liquid Company	Mulberry, FL	Oily Sludge Impoundment (198
Olin Corporation	Ashtabula, OH	Oil/Water Separator (1983)
U. S. Navy	Mayport, FL	Oil/Water Separator (1989)
Pioneer Transport Company	Hennessey, OK	Crude Oil Holding Pits (1983)
General Motors	Kalamazoo, MI	Oil-Contaminated Storm Water Impoundment (1991)
General Motors	Fairfax, KS	Oil-Contaminated Storm Water Impoundment (1991)
Southern California Gas	Needles, CA	Salt Water Holding/Evaporatio Impoundment (1991)
Kenridge Oil Company	Bakersfield, CA	Crude Oil Holding Pits (1983)
Derby Oil Company	Wichita, KS	Oily Watewater Impoundment (1989)
Alyeska Pipeline Service Co.	Valdez, AK	Oily Wastewater Impoundment- (1989)
Exxon Company	Valdez, Seward, Whittier, AK	Oily Wastewater Impoundment (1989)
Capitol City Airport	Lansing, MI	Fuel - Contaminated Runoff Impoundment (1989)
Thriftway Refining	Farmington, NM	Evaporation Pond (1989)
El Paso Natural Gas	Texas, New Mexico	Salt Water Storage Impoundmen (1985)
Union Texas Oil Company	Farmington, NM	Salt Water/Crude Oil (1985)
Helton Oil Company	Helton, OK	Brine Storage Tank (1978)
Snohomish County	Washington	Oily Wastewater Impoundment (1985)
Marathon Oil	Alaska	Salt Water/Oil Impoundments (1988, 1989, 1990)

OWNER	LOCATION	APPLICATION (Installation Year)
Amoco	Colorado-Wyoming	Production Water Sumps (1990)
Mining Applications		
Enselco	Nevada	Cyanide Pond at Gold Mine (1984)
Gold Field Mining	Santa Fe, NM	Cyanide Pond at Gold Mine (1984)
Island Creek Coal Company	West Virginia	Acid Mine Drainage (1987)
Mineral Exploration Company	Pikeville, KY	Dam Face Liner (1988)
Gold Field Mining	Brawley, CA	Heap Leach Pad Ditches (1987,1988, 1989)
Magma Copper	San Manuel, AZ	Electrowinning Process Pond - Copper (1985)
Cypress Mineral Co.	Copperstone, AZ	Heap Leach Pad Ditches Impoundment (1987)
Phelps Dodge	Ignacia, AZ	Copper Processing Wastewater (1989)
Miscellaneous Industrial Process Applications		
Confidential	Oklahoma	Industrial Surface Impoundment - Radioactive sludges (1978)
Westinghouse	Fernald, OH	Denitrification Wastewater (1987)
Revere Copper & Brass	Rome, NY	Containment of Pickle Liquor (1983-86)
Gold Bond Ice Cream	Henderson, NV	Process Wastewater (1987)
NASA	Chalmette, LA	Industrial Surface Impoundment - sulfuric acid (1979)
WRC Processing Company	Pennsylvania	Metal Hydroxide Holding Pit (1983)
Dow Corning Glass Works	Corning, NY	Industrial Wastewater Impoundment (1979)
Weyerhauser	Springfield, OR	Floating Baffle-Pulp and Paper Waste (1986)
Forest Products Company	Panama City, FL	Floating Baffle-Pulp and Paper

Waste (1985)

OWNER	LOCATION	APPLICATION (Installation Year
Millar Western Pulp	Whitecourt, Alberta	Floating Baffle-Pulp and Pape Waste (1987)
Coastal Coca Cola	Marion, SC	Floating Baffle - Food Processing Waste (1985)
DuPont Company	Old Hickory, TN	Plant Runoff Impoundment (198
Tasty Bird Foods	Natural Dam, AR	Floating Baffle - Food Processing Waste (1985)
Alto Dairy	Plymouth, WI	Cheese Plant Impoundment (199
Coca Cola Bottling Co.	Sandwich, MA	Floating Baffle - Food Processing Waste (1985)
Patco Corporation	Missouri	Floating Baffle - Food Processing Waste (1985)
Duke Power	Salem, SC	Floating Baffle - Power Plant Wastewater (1985)
Sun Oil Company	Yabucoa, Puerto Rico	Fire Water Ponds (1979)
Champion Paper Company	Canton, FL	Floating Baffle - Pulp and Pa Waste (1986)
Empire Kosher Poutry	Mifflintown, PA	Wastewater Treatment Impoundm (1990)
Jacksonville Electric Authority	Jacksonville,FL	Acidic Wastewater Impoundment (1985,1987)
Tyson Foods	New Holland, PA	Chicken Processing Wastewater Sludge Impoundment (1988)
Cargill Corporation	Buena Vista, GA	Chicken Processing Wastewater Impoundment (1989)
Penn-York Power Company	New York	Aeration Pond (1983)
Penn-York Power Company	New York	Aeration Pond (1985)
James River Corporation	Pennington, AL	Floating Baffle - Paper Mill Polishing Pond (1990)
Farmland Industries	Doniphan, NB	Urea Storage Pond (1984)

OWNER	LOCATION	APPLICATION (Installation Year)
Deep Run Packing Company	Pennsylvania	Wastewater Impoundment (1992)
Georgia Pacific	Gilman, VT	Fire Water Storage (1984)
Amax Zinc Company	E. St. Louis, IL	Process Water Storage Impoundment (1983)
Westinghouse Electric Co.	Abingdon, VA	Process Water Storage (1984)
International Paper Co.	Mobile, AL	Pulp Waste Lagoon Baffle (1985)
Confidential	Norfolk, Nebraska	Manure Storage (1987)
Air Cap Industries	Manning, SC	Floating Baffle - Neutralization Process Wastewater (1988)
Brookhaven National Laboratory	Uptown, NY	Radioactive Wastewater Impoundment (1988)
EADS Group	Pennsylvania	Coal Prep Plant Runoff (1988)
Confidential	Japan	Process Water at Nuclear Power Plant (1988)
Vlasic Corporation	Dover, DE	Pickle Sludge Lagoon (1988)
American Electric Power	Columbus, OH	Acid Wastewater Impoundment (1987)
Tri Fertilizer Co.	Rocky Mount, NC	Urea Storage Pond (1988)
AT & T	Illinois	Copper Etching Solution (1988)
Energy Plant Constructors	Houston, TX	Process Water Storage (1983)
City of Creston/LaBatts Brewery	British Columbia	Anaerobic Impoundment - Brewery Waste (1991)
Westvaco	Lakeland, FL	Industrial Stormwater Retention (1985)
MDF, Inc.	Albuquerque, NM	Formic Acid Process Waste (1983-84)
Canadian Harvest	Cambridge, MN	Grain Processing Anaerobic Lagoon (1989)

OWNER	LOCATION	APPLICATION (Installation Year)
Confidential	Houston, TX	Sulfuric Acid Spill Retention Pond (1981)
Continental Can Co.	Perry, GA	Process Acidic Wastewater (19[illegible]
Dow Corning	Midland, MI	Plant Runoff Impoundment (199[illegible]
Hallet Dock Company	Duluth, MN	Urea Storage (1978)
Olin Corporation	Jacksonville, FL	Acidic Wastewater (1986)
Confidential	Jersey City, NJ	Vapor/Odor Barrier Underbuild. (1990)
Olin Corp.	Alabama	Cooling Water Pond (1986)
Gulf Power Company	Lynhaven, FL	Neutralization Impoundment (1990)
Wright Corporation	Reigelwood, NC	Formaldehyde/Ammonia Wastewa[illegible] (1990)
Lubrizol Corporation	Deer Park, Texas	Stormwater with Organics Tank Liners (1991)
Lubrizol Corporation	Deer Park, Texas	Process Wastewater Impoundment (1982)
Shell Western	Michigan	Secondary Containment for Sulfinol (1986)
Lindsey Manufacturing	Lindsey, NB	Plating Rinse Water (1984)
Williams Pipeline Company	Oklahoma	Secondary Containment for Ammonium Nitrate (1986)
Monsanto Company	Luling, LA	Sludge Drying Beds (1987)
Norlite Corporation	Albany, NY	Sediment Pond (1990)
Mercer Landmark, Inc.	Celina, OH	Urea Storage Ponds (1986)
Champion Paper	Pensacola, FL	Floating Baffle - Pulp & Pape[illegible] Wastewater (1986)
Ciba Geigy	Mobile, AL	Spill Impoundment - Chemical Storage Warehouse (1991)

OWNER	LOCATION	APPLICATION (Installation Year)
Xerox Corp.	Rochester, NY	Industrial Stormwater Retention (1986)
Tasty Bird - Tyson Foods	Ft. Smith, AR	Chicken Processing Wastewater (1986)
Naval Weapons Station	Coho Junction, California	Industrial Wastewater Impoundment (1988)
Martin Marietta	Paducah, KY	Chlorine/Neutralization Impoundment (1990)
Georgia Power Company	Waynesboro, GA	Deionized Water Storage (1987)
Formosa Plastics	Baton Rouge, LA	Secondary Containment of Industrial Wastewater (1984, 1989)
Chemical Waste Management	Wood River, IL	Tank Liner - Oil (1990)
Philadelphia Gas Works	Philadelphia, PA	Caustic Neutralization Impoundment (1989)
Hickory Springs Manufacturing	Micaville, NC	Fire Water Storage Pond (1990)
Kentucky Laundry	Jamestown, TN	Die-Wash Wastewater Impoundment (1990)

Fuel Containment Applications

New Energy Development Co.	South Bend, IN	Secondary Containment for Fuel Storage (1982)
Bonneville Power Admin.	Oregon, Montana, Washington	Secondary Containment for PCB contaminated Transformer Oils (1985, 1989)
Ashland Petroleum Company	Ashland, KY	Secondary Containment of Oily Wastewater (1988)
United Refinery	Bradford, PA	Oily Wastewater (1987)
City of Hodgkins	Illinois	Secondary Containment for Transformer Oils (1982)
Siemens Energy	Albuquerque, NM	Secondary Containment for Transformer Oils (1987)

OWNER	LOCATION	APPLICATION (Installation Year)
Eastman Kodak Company	Rochester, NY	Secondary Containment for Fuel Oil (1986)
Georgia Power Company	Atlanta, GA	Secondary Containment of Motor Oil (1985, 1986)
Ashland Petroleum Company	Kentucky, Ohio, Minnesota Pennsylvania	Secondary Containment for Diesel, Jet Fuel, Kerosene, Naptha, Ethanol, Methanol (1987-90)
Manitoba Hydroelectric	Winnepeg, Manitoba	Secondary Containment for Transformer
Ashland Chemical Company	Baton Rouge, LA	Secondary Containment for Methanol (1989)
Public Service of New Hampshire	Manchester, NH	Secondary Containment for Transformer Oil (1990)
Kiwi Brands	Douglasville, PA	Secondary Containment of Min Spirits (1987)
3M	Perth, Ontario	Secondary Containment of Fuel Oil (1987)
Consolidated Chemical	Ferrel, Yukon Terr.	Secondary Containment of Fuel Oil (1987)
Cannon AFB	Clovis, NM	Secondary Containment of JP4 (1988)
Homestead Air Force Base	Homestead, FL	Secondary Containment for Jet Fuel Storage (1985)
Truckstops of America	Knoxville, TN	Secondary Containment of Diesel (1991)
General Electric	Cincinnati, OH	Secondary Containment for Jet Fuel Storage (1987)
Manitoba Hydro	Winnepeg, Manitoba	Secondary Containment for Dies Fuel (1986)
Manitoba Hydro	Brochet Station, Manitoba	Secondary Containment for Dies Fuel (1987)
Carolina Freight	Sauk Village, IL	Secondary Containment for Abo ground (1990)

OWNER	LOCATION	APPLICATION (Installation Year)
Gulf Canada	Peace River, Alberta Canada	Secondary Containment for Diesel Fuel (1985)
Port Clarence	Alaska	Secondary Containment for Diesel Fuel (1988)
City of Seattle	Washington	Secondary Containment for PCB-Containment Transformer Oils (1985)
Malstrom Air Force Base	Great Falls, MT	Primary Containment for Jet Fuel (1985)
Central Hudson Gas & Electric	Albany, New York	Secondary Containment for Fuel Oil (1990)
Confidential	West Virginia	Ground Water Cut-off Wall for Diesel Fuel (1986)
Northern Canadian Power Commission	Inuvik, N.W.T.	Secondary Containment for Diesel Fuel(1986)
Martin Marietta - Dept. of Energy	Oak Ridge, TN	Secondary Containment of PCB - Contaminated Soil (1989)
Confidential	Oregon	Secondary Containment of Aircraft Oil on Airplanes (1989)
General Motors	Kalamazoo, MI	Fuel Containment Runoff Impoundment (1990)
Exxon Co. USA	Oxnard, CA	Secondary Containment for Diesel Fuel (1987)
Simmons Air Lines	Lansing, MI	Secondary Containment for Jet Fuel (1985)
Boeing Co.	Lake Charles, LA	Secondary Containment for Jet Fuel (1988)
City of Farmington	New Mexico	Secondary Containment for Diesel Fuel (1985)
Data General	Colorado Springs, CO	Secondary Containment for Diesel Fuel (1986)
Niagara Mohawk Power Co.	Syracuse, NY	Secondary Containment for Transformer Oil (1987, 1990)

OWNER	LOCATION	APPLICATION (Installation Year
Plaines Electric Power	Albuquerque, NM	Secondary Containment for Transformer Oil (1987)
Wheeler Air Force Base	Honolulu, HI	Secondary Containment of Jet Fuel (1987)
Ontario Hydroelectric	Ontario	Secondary Containment for Dies Fuel and Fuel Oil (1986)
U. S. Coast Guard	Erie, PA	Secondary Containment for Dies Fuel and Fuel Oil (1986)
Capitol City Airport	Lansing, MI	Secondary Containment for Jet Fuel (1986)
Indiana Municipal Power Agency	Richmond, IN	Secondary Containment for Fuel Oil (1991)
Indiana Municipal Power Agency	Anderson, IN	Secondary Containment for Fuel Oil (1991)
Louisiana Offshore Oil Port	New Orleans, LA	Jet Fuel Burn Pit (1988)
Alyeska Pipeline Service Co.	Valdez, AK	Fire Training Pit (1988)
Pratt Whitney Aircraft	West Palm Beach, FL	Primary Containment of Jet Fue & Water (1985-1986)
Dyess Air Force Base	Abilene, TX	Secondary Containment of JP4 J Fuel (1985)
Martin Marietta	Orlando, FL	Secondary Containment for Dies Fuel (1987)
Tyree Contractors	Long Island, NY	Secondary Containment for Dies Fuel (1984-85)
Dane County Airport	Madison, WI	Runoff Impoundment to hold Ethylene Glycol and JP4 (1991)
Haskill Corportion	Bellingham, WA	Secondary Containment for Dies Fuel (1986)
Duke University	Durham, NC	Secondary Containment for No. Fuel Oil (1986)
Grand Forks AFB	North Dakota	Fire Training Pit (1988)
TRW	Houston, TX	Secondary Containment of Diese Fuel (1987)

OWNER	LOCATION	APPLICATION (Installation Year)
Chevron Resources	Norman Wells, N.W.T.	Secondary Containment of Diesel Fuel (1988)
Trans Alberta Utilities	Alberta	Secondary Containment of Transformer Oil (1988)
Petro Canada	Dawson Creek, Alberta	Secondary Containment of Diesel Fuel (1988)
Sandia Labs	Albuquerque, NM	Secondary Containment of Fuel Oil (1988)
Alyeska Tank Farm	Valdez, AK	Secondary Containment for Crude Oil (1987)
Texas Eastern	Seymour, IN	Containment of Gasoline, Jet Fuel & Fuel Oil Containmanted Storm Water (1988)
Esso Canada	Nova Scotia	Secondary Containment of Diesel Fuel (1986)
Mayport Naval Station	Jacksonville, FL	Secondary Containment of Diesel Fuel (1989)
Suguaro Power Plant	Henderson, NV	Secondary Containment of Diesel Fuel (1991)
State of New Mexico	Albuquerque, NM	Secondary Containment for Jet Fuel (1988)
Associated Air Center	Dallas, Texas Love Field	Secondary Containment for Jet Fuel (1987)
Chandler-Evans Corp.	Hartford, CT	Ground Water Cut-off Wall - Jet Fuel (1988)
Enterprise Oil Company	Loudon, TN	Secondary Containment for Waste Oil (1987)
Standard Oil of Ohio	Dayton, OH	Containment of Fuel & Contaminated Run-off (1987)
Australian Coast Guard	Australia	Bunker Oil Primary Containment (1986)
Canadian Coast Guard	Canada	Bunker Oil Primary Containment (1986)

OWNER	LOCATION	APPLICATION (Installation Yea
City of Dallas	Texas	Secondary Containment for Di Fuel (1986)
State of New Mexico	Albuquerque	Jet Fuel Containment - Fire Training Facility (1988)
Ohio Edison	Akron, OH	Secondary Containment of Transformer Oil (1989, 1990)
Sikorsky Aircraft	New Haven, CT	Secondary Containment for Hydraulic Fluid (1991)
Indiana-Michigan Power Co.	Ft. Wayne, IN	Secondary Containment of Transformer Oil (1990)
Solar Corporation	San Diego, CA	Secondary Containment for Die Fuel (1987)
Redstone Arsenal	Huntsville, AL	Secondary Containment for Jet and Diesel Fuel (1988)
Nestle's Corp.	Milwaukee, WI	Secondary Containment for Fue Oil (1987)
City of Farmington	New Mexico	Secondary Containment for PCB Contaminated Transformer Oil (1988)
Naval Air Station	Marietta, GA	Secondary Containment for Jet Fuel (1988)
Shell Oil Company	Edmonton, Alberta	Secondary Containment for Die Fuel (1989)
Peach State Rubber	Tucker, GA	Secondary Containment for Transformer Oil (1990)
Port of Portland	Portland, OR	Run-off Containment - Jet Fuel Storage Areas (1989)
Trans Mtn. Enterprises	Vancouver Airport, BC	Groundwater Cut-off Wall - Jet (1989)
U. S. Air Force	Grand Forks AFB, ND	Aboveground Secondary Containment - JP4 (1989)
U. S. Air Force	Castle AFB, CA	Aboveground Secondary Contai ment - JP4 (1990)

OWNER	LOCATION	APPLICATION (Installation Year)
Tampa Airport	Florida	Runoff Impoundment for Parking Area (1990)
	Floating and Top Covers	
McCain Foods	Harnes, France	Floating Cover - Methane Containment in Anaerobic Lagoon (1980)
Brown Packing Co.	Gaffney, SC	Floating Cover - Methane Containment in Anaerobic Lagoon (1988)
McCain Foods	Harnes, France	Floating Cover - Methane Containment in Anaerobic Lagoon (1988)
McCain Foods	Whittelsey, England	Floating Cover - Methane Containment in Anaerobic Lagoon (1989)
McCain Foods	Bethune, France	Floating Cover - Methane Containment in Anaerobic Lagoon (1987)
Gardiner Phosphorus Co.	Tampa, FL	Top Cover for Phosphoric Acid Tanks - subjected to fumes at elevated temperatures (1987)
Cornell University	New York	Floating Cover - Methane Containment in Anaerobic Lagoon (1981)
McCain Foods	Charlottetown, PEI	Floating Cover - Methane Containment in Anaerobic Lagoon (1990)
A. E. Staley	Lafayette, IN	Floating Cover - Methane Containment in Anaerobic Lagoon (1985)
Mid-American Dairies	Springfield, MO	Floating Cover - Methane Containment in Anaerobic Lagoon (1985)
City of Memphis	Tennessee	Floating Cover - Methane Containment in Anaerobic Lagoon (1990)

OWNER	LOCATION	APPLICATION (Installation Year
Quesnel River Pulp	British Columbia	Floating Cover - Methane Containment in Anaerobic Lagoon (1990)
Alco Aluminum	Frederick, MD	Floating Cover - Runoff Water (1990)
Twin City Foods	Prosser, WA	Floating Cover - Methane Containment in Anaerobic Lago (1987)
Canadian Harvest (Div. of Conagra)	Cambridge, MN	Floating Cover - Methane Containment in Anaerobic Lago (1989)
Rohm & Haas	Babylon, NY	Top Cover for Acid Tanks (199
Cornell River Pulp Mill	British Columbia	Floating Cover Methane Containment in Anaerobic Lago (1989)
Elf Oil	Pau, France	Floating Cover - Refinery Ru off (1988)
U.S. EPA - Como Refinery	Westville, IN	Floating Cover - Refinery Wastewater (1987, 1989)
Confidential	India	Floating Covers - Methane Containment in Anaerobic Lago (1987, 1988, 1989, 1990)
Farmland Industries	Doniphan, NB	Floating Covers - Ammonium Nitrate (1984)
Farmland Industries	Lawrence, KS	Floating Covers - Ammonium Nitrate (1987)
City of Creston	British Columbia	Floating Cover-Methane Containment in Anaerobic Lagoon - Brewery Waste (1991)
Arizona Dairies	Phoenix, AZ	Top Cover - Methane Containmer in Anaerobic Digestor (1982)
ITT Rayonier	Port Angeles, WA	Top Cover - Methane Containmer in Anaerobic Digestor (1980)
Pima County	Tucson, AZ	Floating Cover - Sewage Sludg Storage Basin (1986)

OWNER	LOCATION	APPLICATION (Installation Year)
M & M Dairies	Gonzales, CA	Top Cover - Methane Containment in Anaerobic Digestor (1985)
J. H. Miles Co.	Norfolk, VA	Floating Cover - Methane Containment (Clam Processing Wastewter)
City of San Lajeo	California	Floating Cover - Sewage (1991)
Hollywood Brands	Centralia, IL	Floating Cover - Methane Containment in Anaerobic Digestor
Unisyn Power Company	Hawaii	Top Cover - Methane Containment in Anaerobic Digestors (1986, 1989)
North Carolina State University	Raleigh, NC	Top Cover - Methane Containment in Anaerobic Digestor (1985)
Consolidated Waste Services	Norridgewock, ME	Floating Cover - Sanitary Landfill Leachate Pond
Luis Farms	Lodi, CA	Top Cover - Methane Containment in Anaerobic Digestor (1985)
City of Eau Claire	Wisconsin	Suspended Cover - Methane Containment in Anaerobic Digestor (1984)
City of Grinnell	Iowa	Suspended Cover - Methane Containment in Anaerobic Digestor (1984)
City of Indianola	Iowa	Suspended Cover - Methane Containment in Anaerobic Digestor (1984)
Casco Company	Cardinal, Ontario	Floating Cover - Methane; Containment in Anaerobic Digestors - Corn Oil Wastewater (1988)
GLI, Inc.	Newport, TN	Floating Cover - Methane: Containment in Anaerobic Digestors - Pharmaceutical Wastewater (1988)

OWNER	LOCATION	APPLICATION (Installation Year
High's Dairy	Fredericton, MD	Floating Cover-Methane Containment in Anaerobic Digestors - Dairy Waste (1989)
City of Fairfield	Ohio	Top Cover - Methane Containme in Anaerobic Digestor (1987)
City of East Liverpool	Ohio	Top Cover - Methane Containme in Anaerobic Digestor (1987)
City of New Oxford	Ohio	Top Cover - Methane Containme in Anaerobic Digestor (1987)
City of Halton	Alberta	Floating Cover - Methane Containment in Anaerobic Digestor (1988)
	Miscellaneous Applications	
Browning Ferris	New Hudson, MI	Sanitary Landfill - XR-5 used side slopes of 190' - excell tensile strength required (1. 1986, 1987, 1989)
U. S. Army Corps of Engineers	Michigan	Riprap Liner - high puncture resistance required and containment of PCB -Contaminat Sludges (1984)
City of Bradenton	Florida	Sea Wall - Prevention of salir intrusion into fresh water supplies (1983)
City of San Francisco	California	Erosion control under steep water supply line; XR-5 laid c irregular rocks (1985)
City of Madison	Wisconsin	Sanitary Landfill Leachate Dra (1985)
U. S. Dept. of the Interior	Kentucky	Sewage Lagoons (1983)
U. S. Dept. of the Navy	Kings Bay, GA	Sewage Lagoons (1986)
McDonald's Corporation	Vancouver, B.C.	Underliner for Floating Restaurant (1986)
City of Lake LBJ	Texas	Sewage Lagoon (1986)

OWNER	LOCATION	APPLICATION (Installation Year)
Confidential	Monterey Park, CA	Methane Barrier under building (1986, 1988)
City of Savannah	Missouri	Sewage Containment (1986)
Municipality	Florida	Floating Baffle - Sewage Lagoon (1986)
Municipality	Wyoming	Floating Baffle - Sewage Lagoon (1986)
City of Brooklyn	Ohio	Sanitary Landfill Cutoff Wall (1991)
Enterprise Building Corp.	Tampa, FL	Storm Water Ditch Liner under Rip-rap (1986)
Michigan Dept. of Transportation	Kalkaska, MI	Salt Storage Runoff Impoundment (1987)
Browning Ferris	Arbor Hills, MI	Landfill Runoff and Leachate Impoundment (1991)
City of Austin	Texas	Floating Baffle - Municipal Sewage (1986)
U. S. Park Service	Blanding, Utah	Sewage Lagoon (1986)
U. S. Army Corps of Engineers	Ft. Stewart, GA	Liner for Vehicle Wash Facility (1987)
Hope Indian Reservation	Arizona	Floating Baffle - Municipal Sewage (1986)
Effingham County	Georgia	Floating Baffle - Municipal Sewage (1986)
White Sands Lockheed Corp.	Las Cruces, NM	Tank Liner (1988)
Pacific Gas & Electric Co.	Wyoming	Stormwater Ditch Liner (1986)
Parizian's	Alabama	Water Barrier (1986)
City of Arkadelphia	Arkansas	Floating Baffle - Municipal Sewage (1987)
City of Malvern	Arkansas	Floating baffle - Municipal Sewage (1987)

OWNER	LOCATION	APPLICATION (Installation Year)
City of Chickasaw	Alabama	Floating Baffle - Municipal Sewage (1987)
City of Tickfaw	Louisiana	Floating Baffle - Municipal Sewage (1991)
City of Tracy	California	Floating Baffle - Municipal Sewage (1988)
U. S. Dept. of Energy	Aiken, SC	Floating Baffle - Cooling Water (1986)
U.S. Park Service	Natural Bridges, Utah	Sewage Lagoon (1987)
City of Salisbury	Maryland	Sewage Containment (1989)
National Starch Co.	Kansas City, MO	Floating Baffle - Process Wastewater (1987)
Glen Canyon National Recreational Area	Lake Powell, UT	Sewage Lagoon (1987)
City of New London	Iowa	Floating Baffle - Municipal Sewage (1987)
City of Braithbridge	Ontario	Sewage Tank (1987)
City of Greenville	Kentucky	Sewage Lagoon (1987)
City of Harrisburg	Pennsylvania	Fire Water (1987)
Saylorville Rec. Area - USACE	Des Moines, Iowa	Sewage Lagoon (1987)
TN Valley Authority	Norris, TN	Process Wastewater (1988)
City of Brunswick	Georgia	Sewage Lagoon (1988)
Fort Howard Paper Co.	Muskogee, OK	Floating Baffle - Pulp & Paper Lagoon (1988)
Gulf of Maine Research Center	Salem, MA	Containment of Soil Contaminated with Chicken Manure and Fuel Oil (1989)
Monroe Township	New Jersey	Sewage Tank (1988)
City of Mobile	Alabama	Sludge Drying Beds (1988)

APPENDIX 4F

SUPPORTING ENGINEERING ANALYSES

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Volatile Organic Concentrations in the Inlet to the 1706-KE Building Ventilation System Charcoal Filter Using "Spike" Concentrations

Purpose

The purpose of this analysis is to calculate the expected inlet concentrations to the 1706-KE Building charcoal system so that the expected breakthrough concentration setpoint for the volatile organic chemicals (VOC) analyzer can be determined.

Assumptions

1) The charcoal system is on the ventilation branch for the tank vents. The tanks vented include: tanker trucks (2), intermediate storage tanks (2), surge tanks (2) and filtrate tank.

2) Liquid treatment feed rate: 5 gallons per minute (nominal)

3) Vent flow rate: 50 cubic feet per minute (cfm) (rating for TIGG Model N50 at 7 inches H_2O)

4) The average molecular weight of the five most prominent compounds in Table 4-3 is 67.5. These five compounds (1-butanol, acetone, pyridine, carbon disulfide, and formic acid) make up 92 percent of the volatile organics present in the spiked feed.

5) Feed concentration: 2.989 pounds (lb) VOC per 1,000 gallons (gal). This is the maximum concentration as stated in Table 4-3.

Calculations

Assuming 100 percent volatilization of the max concentrations and temperature of 70 °F [529 °Rankine (°R)]:

$$\left(5\ \frac{\text{gal}}{\text{minute}}\right)\left(\frac{2.989\ \text{lb VOC}}{1{,}000\ \text{gal}}\right)\left(\frac{1\ \text{lb-mole}}{67.5\ \text{lb VOC}}\right)\left(359\ \frac{\text{ft}^3}{\text{lb-mole}}\right)\left(\frac{529\ ^\circ\text{R}}{492\ ^\circ\text{R}}\right) =$$

$$\left(0.08531\ \frac{\text{ft}^3\ \text{VOC}}{\text{min}}\right)$$

$$\frac{(0.08531\ \text{cfm VOC})\ (1{,}000{,}000)}{50\ \text{cfm total}} = 1{,}706 \text{ parts per million VOC}$$

Therefore, if only 10 percent of the volatile organic compounds are volatilized, then the VOC concentration to the charcoal would be 171 parts per million. Likewise, if only 1 percent volatilization occurs, then the inlet concentration would be 17 parts per million.

Conclusions

Because the pilot plant is designed to minimize the volatilization of feed compounds, the value of 1 percent of the maximum concentrations is realistic. The recommended VOC analyzer control point should be 10 parts per million. This will be low enough to detect breakthrough, but should be high enough to prevent false alarms.

Analysis prepared by:

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Chemical Engineering Laboratory
Westinghouse Hanford Company
November 12, 1992

Volatile Organic Concentration in Tank Trailer Ventilation Air at the Liquid Effluent Retention Facility Load/Unload Station

Purpose

The purpose of this analysis is to estimate the volatile organic compound (VOC) concentration in the air vented during the filling of the tank trailer at the LERF load/unload station.

Assumptions

1) The VOC concentrations used in this analysis are the 90 percent confidence interval values reported in Table 4-2.

2) The average molecular weight of the VOC is 73. This is a weighted average value based on the molecular weights of acetone (58) and 1-butanol (74). These two compounds contribute 97 weight percent of the VOC in the waste water. (Table 4-2, "90 percent confidence values).

3) 100 weight percent of the VOC are volatilized into the trailer ventilation air stream.

4) One gallon of tank trailer air is vented for every gallon of wastewater pumped into the tank trailer.

5) Maximum VOC loading in the wastewater is 12.4 parts per million (ppm), or 0.517 pounds (lbs) VOC per 5,000 gallons (gal).

6) The temperature is 70 degrees Fahrenheit ($^{\circ}$F) [529 degrees Rankine ($^{\circ}$R)].

Calculation

$$\text{VOC (ppm)} = (0.517 \text{ lb VOC}/5{,}000 \text{ gal}) \times (7.48 \text{ gal/ft}^3) \times (529\ ^{\circ}\text{R}/491\ ^{\circ}\text{R}) \times (1 \text{ lb-mole VOC}/73 \text{ lb VOC}) \times (359 \text{ std ft}^3/\text{lb-mole}) \times 1{,}000{,}000$$

$$= 4{,}100 \text{ ppm}$$

However, if only 10 weight percent of the VOC is volatilized, then the VOC concentration to the charcoal adsorber would be 410 ppm. Likewise, if only 1 weight percent volatilization occurs, then the inlet concentration would be 41 ppm.

Conclusions

Because the trailer loading is conducted through a submerged outlet, volatilization will be minimal and is expected to be approximately 1 weight

Volatile Organic Concentration in Tank Trailer Ventilation Air at the Liquid Effluent Retention Facility Load/Unload Station (cont)

percent. Therefore, the "maximum" feed case, the VOC concentration in the tank trailer exhaust air (feed to the carbon adsorber) will be approximately 40 ppm.

Analysis prepared by:

D. E. Scully
Effluent Process Engineering
Westinghouse Hanford Company
November 11, 1992

Berm Liner Stress Analysis

Purpose

The purpose of this analysis is to calculate the maximum acceleration that a loaded tank trailer can attain before the berm liner will fail in shear.

The maximum stress on the berm liner occurs during acceleration during starting. The failure mode is assumed to be shear of the PVC polymer coating under the driven axle. No credit is taken for the polyester fiber reinforcement.

Assumptions

1. The tensile strength of general, non-rigid PVC is taken as 1000 psi as referenced in the *Materials Journal* (December 1989, page 168). This is a conservative assumption because the listed range of tensile strength is 1000-3500 psi.

2. The shear strength is taken as 50 percent of the tensile strength. This is a conservative estimate because the shear strength is 60 to 70 percent of the tensile strength for most materials.

3. The loaded weight of the combined tractor and trailer is 78,000 lbs.

4. The weight over the driven wheels is 17,000 lbs.

5. The tire pressure is 125 psi gage.

Calculations

1. Contact area (A) of the driven wheels: A = 17,000 lbs /125 psi = 136 square inches

2. Mass (m) of the tractor and trailer: m = 78,000 lbs force/32.2 ft/sec^2 = 2422 lbs force - sec^2/ft

3. Force needed to accelerate the tractor and trailer to an acceleration (a) is equal to the reaction shear force in the berm (F). $F=m \bullet a$ then $a=F/m$.

4. Shear in the berm (τ) is equal to the reaction force (F) distributed divided by the area of contact (A) of the driven tires. $\tau = F/A$ then $F=\tau \bullet A$

5. Combining statements 3 and 4: $a = F/m = \tau \bullet A/m$.

6. Assuming that the maximum shear allowable is 500 psi, the maximum allowable acceleration can be calculated as follows:

   $a = \tau \bullet A/m$ = (500 psi)(136 square inches) / (2422 lb force-sec^2/ft) = 28 ft/sec^2.

Conclusions

As shown in the calculations in Step 6, stress failure occurs in the liner at an acceleration of 28 ft/sec^2. Stopping is not a concern because the stress would be distributed between 5 axles, instead of the 1 axle assumed for acceleration.

Operating procedures will limit truck speed to 5 mph maximum. The maximum acceleration or deceleration is limited to 5 mph/sec. Five mph/sec is equivalent to:

(5 mph/sec)x(5280 ft/mi)/(3600 sec/hr) = 7 ft/sec^2.

The 7 ft/sec^2 is well below the maximum allowable acceleration of 28 ft/sec^2 calculated above.

The 5 mph speed limit will provide a safety factor of approximately 4.

Abbreviations

ft = feet

ft/mile = feet per mile

ft/sec^2 = feet per second squared

in^2 = square inches

lbs = pounds

mi = mile

mph = miles per hour

psi = pounds per square inch

sec/hr = seconds per hour

sec^2/ft = seconds squared per foot.

Analysis prepared by:

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April 7, 1992

Berm Liner Seam Load Failure Analysis

Purpose

The purpose of the seam load failure analysis is to calculate the maximum acceleration that a loaded tank trailer can attain before seam failure occurs in the XR-5 8130 geomembrane secondary containment liner manufactured by the Seaman Corporation. Limits on trailer acceleration are to be calculated to provide a safety margin for the prevention of seam failure.

Assumptions

1. The maximum shear stress on the geomembrane liner occurs during acceleration of the tank trailer during starting. The failure mode is assumed to be shear of the geomembrane fabric seam weld lying under the driven axle of the tractor.

2. The dead load seam shear is 210 pounds per inch (lbs/in) at 70 °F and 105 lbs/in at 160 °F as determined using procedure Mil-T-52983E, Para. 4.5.2.19, 2-inch overlap seam. This is reported in the "Technical Data and Specifications for XR-5" by the Seaman Corporation (Appendix 4E).

   The seam shear strength for this analysis is conservatively assumed to be the smaller of these two reported values (105 lbs/inch). Because the area of the welded seam for the test specimen is 1 inch wide by 2 inches deep (the overlap), the bonded area is 2 square inches. Therefore, the 160 °F seam shear strength is equal to 105 lbs per 2 square inches. The seam strength is equal to 52.5 pounds per square inch (psi).

3. The loaded weight of the combined tractor and trailer is 78,000 pounds (lbs).

4. The weight over the driven wheels is 17,000 lbs.

5. The tire pressure is 125 psi gage.

Analysis

1. Contact area (A) of the driven wheels:

   A = 17,000 lbs/125 psi = 136 square inches.

2. Mass (m) of the tractor and trailer:

   m = 78,000 lbs force/32.2 ft/sec^2 = 2,422 lbs force - sec^2/ft.

3. Force needed to accelerate the tractor and trailer to an acceleration (a) is equal to the reaction shear force in the berm (F).
   F=m•a. Then a=F/m.

4. Shear at the berm seam (τ) is equal to the reaction force (F) divided by the area of contact (A) of the driven tires.
   $\tau = F/A$. Then $F = \tau \bullet A$.

5. Combining statements 3 and 4: $a = F/m = \tau \bullet A/m$.

6. Assuming that the maximum shear allowable is 52.5 psi, the maximum allowable acceleration can be calculated as follows:

   $a = \tau \bullet A/m$
   $= (52.5\text{ psi})(136\text{ square inches})/(2422\text{ lb force-second}^2/\text{foot})$
   $= 2.9\text{ feet/second}^2$.

Conclusions

As shown in the analysis in Step 6, shear stress failure occurs in the liner seam at an acceleration of 2.9 feet/second^2. Stopping (deceleration) is of less concern because the stress would be distributed between 5 axles, instead of the 1 axle assumed for acceleration.

Operating procedures will limit truck speed when entering or leaving the berm to 5 miles per hour (mph) maximum. The maximum acceleration or deceleration will be limited to 1 mph per sec.

One mph/sec is equivalent to:

$$(1\text{ mph/sec})\text{x}(5{,}280\text{ ft/mi})/(3{,}600\text{ sec/hr}) = 1.5\text{ ft/sec}^2.$$

The 1.5 ft/sec^2 is below the maximum allowable acceleration of 2.9 ft/sec^2 calculated above, and will provide a safety factor of approximately 2.

This analysis does not take credit for the load distribution that will be provided by the 100 mil geotextile and the 5/16 inch thick neoprene mat that will cover the upper surface of the geomembrane liner.

Analysis prepared by:

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Westinghouse Hanford Company
July 28, 1992

Berm Liner Puncture Failure Analysis

Purpose

The purpose of this analysis is to determine under what conditions the Seaman Corporation XR-5 8130 geomembrane secondary containment liner could fail due to puncture.

Assumptions

1. The trailer tire pressure is 125 pounds per square inch (psi).

2. The XR-5 8130 geomembrane puncture resistance is 350 pounds (lbs) as determined by procedure "Federal Test Method Standard" (FTMS) 101B, Method 2031 ("Technical Data and Specifications for XR-5" included in Appendix 4E)

Analysis

A sharp pointed rock lying above or below the geomembrane and driven over by a trailer tire will be considered the most likely mechanism for geomembrane puncture failure.

Assuming that a force of 350 lbs must be applied on the rock to cause puncture, the size (diameter) of the rock necessary to generate this force can be calculated as follows:

$$F = PA \quad (Equation\ 1)$$

where F = the force exerted at the rock point
A = the cross-sectional area of the rock
P = the pressure exerted on the rock by the trailer tire.

F = the puncture force at failure = 350 lbs

P = tire pressure = 125 psi.

Rearranging Equation 1,

$$A = \frac{F}{P} = \frac{350\ lbs}{125\ p.s.i.} = 2.8\ square\ inches$$

Then the diameter of the rock is

$$D = \sqrt{4\frac{A}{\pi}} = \sqrt{4\frac{2.8}{\pi}} = 1.89\ inches.$$

For a safety factor of 15, the applied force, and consequently the rock cross-sectional area, would be reduced by a factor of 15. The maximum diameter of the rock, then, would be

$$D = \sqrt{4\frac{A}{15\pi}} = \sqrt{4\frac{2.8}{15\pi}} = 0.5\ inches.$$

This analysis does not take credit for the load distributing properties of the 100 mil geotextile that will be placed above and below the liner, or the 5/16-inch neoprene mat that will be placed over the upper geotextile.

Conclusions

To preclude fabric puncture by a safety factor of 15, all rocks and other extraneous matter larger than 0.5 inches in diameter will be absent from the surfaces above and below the XR-5 geomembrane liner.

The foundation subgrade upper course shall be composed of aggregate no larger than minus 0.5 inches. The tractor and trailer tires will be carefully inspected just before trailer entry onto the berm floor. Any rocks embedded in the tire treads will be removed at this time.

Analysis prepared by:

D. E. Scully
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Westinghouse Hanford Company
July 27, 1992

Berm Liner Impact Failure Analysis

Purpose

The purpose of this analysis is to determine the limitations of the Seamans XR-5 8130 geomembrane secondary containment liner with respect to impact strength.

Assumptions

1. The "Technical Data and Specifications for XR-5" included in Appendix 4E describe this geomembrane as a polyester fabric with an ethylene intermolecular alloy coating. The Seamans representative in Bellevue, Washington, has indicated that this coating is a polyvinyl chloride (PVC) polymer with an Elvaloy modifier. 'Elvaloy' is a trademark of the E. I. DuPont de Nemours & Company. The modifier replaces the plasticizer that normally is added to flexible PVC. The Elvaloy provides the flexibility normally supplied by a plasticizer while also providing increased chemical resistance.

2. Impact resistance test data are not available for the XR-5 geomembrane. The general literature also does not contain any impact resistance values for flexible PVC. However the April 17, 1986 issue of *Machine Design* gives the Izod impact resistance of rigid PVC as 0.4 to 20.0 foot pounds per inch (ft-lb/in) of notch (ASTM D256).

   The upper value of this range for rigid PVC will be used for this analysis. No credit will be taken for the polyester fiber reinforcement present in the XR-5 geomembrane.

3. Accidental dropping of a heavy tool with a pointed edge will be considered the most likely scenario for impact damage to the liner. No credit will be taken for the 100 mil geotextile and the 5/16 inch neoprene rubber mat that will be covering the upper surface of the berm.

Analysis

The value of 20 ft-lb/in indicates that a heavy pointed object, dropped from a sufficient height, could fracture the unprotected fabric. For purposes of analysis, a 5-pound crow bar, with a 1-inch wide chisel end will be used.

If the crow bar is dropped from a height equal to or greater than 4 feet, impact failure of the berm liner would be expected.

Conclusions

Based on this analysis, a procedural requirement will be established prohibiting the use of tools heavier than 1 pound with pointed edges over the berm without a written waiver from the manager of the Engineering and Environmental Development Laboratory. The issuance of this waiver will include the counseling of the user of the tool on the impact damage risk associated with the use of this tool.

Analysis prepared by:

D. E. Scully
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Westinghouse Hanford Company
July 27, 1992

Berm Liner Compression Failure Analysis

Purpose

The purpose of this analysis is to determine under what conditions the Seamans XR-5 8130 geomembrane secondary containment liner could fail in compression, and the factor of safety for the intended usage.

Assumptions

1. The "Technical Data and Specifications for XR-5" booklet (included in Appendix 4E) does not list the compressive strength of the XR-5 geomembrane. However, the hydrostatic resistance (ASTM D-751, Method A) is given as a minimum of 500 pounds per square inch (psi). This indicates that at 500 psi hydrostatic pressure (a compressive stress condition), the geomembrane liner can fail. The value of 500 psi will be taken as the compressive strength of the XR-5 geomembrane.

2. The trailer tire pressure is 125 psi.

Analysis

The maximum compressive loading on the XR-5 geomembrane liner is equal to the trailer tire pressure, that is, 125 psi. Therefore, the geomembrane liner is not expected to fail in compression. The factor of safety is 500 psi divided by 125 psi and is equal to 4.

This analysis does not take credit for the load distributing properties of the 100 mil geotextile or 5/16-inch neoprene mat that will be covering the upper surface of the XR-5 geomembrane.

Conclusions

No geomembrane liner failure due to compressive loading is anticipated.
A safety factor of 4 exists.

Analysis prepared by:

D. E. Scully
Effluent Process Engineering
Westinghouse Hanford Company
July 27, 1992

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Induced Berm Liner Stress From Pavement Deflection Analysis

Purpose

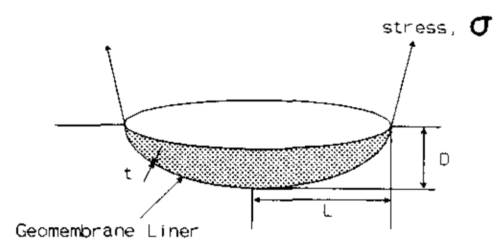
The purpose of this analysis is to determine the amount of berm foundation settlement or 'deflection' that is tolerable before failure of the Seaman XR-5 geomembrane berm liner.

Assumptions

1. The mathematical model presented in Page A-16 of "Design and Construction of RCRA/CERCLA Final Covers" (EPA/625/4-91/025, May 1991) is applicable. This model was developed for the "Tensile Stresses in a Geomembrane Mobilized by Cover Soil and Caused by Subsidence."
2. The cover soil pressure term (density of the cover soil x height of the cover soil) can be represented by the trailer tire pressure. This is 125 pounds per square inch (psi).
3. The radius of the subsidence can be represented as the tire width for a dual tire system. This is 10 inches.
4. The XR-5 geomembrane thickness is 0.030 inches ("Technical Data and Specifications for XR-5 Geomembrane" included in Appendix 4E).
5. The XR-5 geomembrane tensile strength is 425 pounds per 4-inch wide test strip (grab tensile per ASTM-D-751) ("Technical Data and Specifications for XR-5 Geomembrane" included in Appendix 4E).

Analysis

The tensile stress induced in the geomembrane due to the deflection induced by subsidence is calculated with the following modified equation and is illustrated in the sketch.



SETTLEMENT SKETCH

$\sigma = 2DL^2p/[3t(D^2 + L^2)]$ (Equation 1)

where,

σ = geomembrane tensile stress
D = deflection in inches
L = radius of the depression in inches
p = pressure on the berm geomembrane in psi, and
t = thickness of the geomembrane in inches.

Induced Berm Liner Stress From Pavement Deflection Analysis (cont)

The geomembrane tensile stress at failure, σ_F, can be calculated from the grab tensile strength as follows,

$$\sigma_F = 425 \text{ pounds}/(4 \text{ inches} \times 0.030 \text{ inches}) = 3{,}542 \text{ psi}.$$

Assuming a safety factor of 2, the allowable tensile stress, σ_A, would be

$$\sigma_A = \sigma_F/2 = 1{,}771 \text{ psi}.$$

By substituting this value (1,771 psi) for tensile stress in Equation 1 above, the allowable deflection, D_A, can be calculated, i.e.,

$$1{,}771 \text{ psi} = 2D_A(10 \text{ inches})^2(125 \text{ psi})/[3(0.030 \text{ inches})(D_A^2 + (10 \text{ inches})^2)].$$

By trial and error iteration, D_A is found to be 0.64 inches.

<u>Conclusions</u>

Assuming a safety factor of 2, the allowable defection of the berm geomembrane due to foundation settlement under the dual tires is 0.64 inches. The "Asphalt Pavement Analysis" in this appendix concluded that the maximum deflection under a dynamic load is 0.013 inches.

Analysis prepared by:

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Westinghouse Hanford Company
October 7, 1992

Asphalt Pavement Deflection Analysis

Purpose

The purpose of this analysis is to determine the deflection of the asphalt pavement berm foundation when under load. The load will consist of a 5-axle tractor-trailer. The trailer consists of a 5,000 gallon tank loaded with waste water.

Assumptions

1. Trailer tire pressure is 125 pounds per square inch (psi).
2. The pavement is Class B asphalt concrete (WSDOT 1991), 4.2 inches in depth, placed on a compacted base.
3. The pavement modulus of elasticity is 400,000 psi (Telecon 10/6/92 with Brian Wilson, Shannon & Wilson, Richland, Washington, referring to information received from the Washington State Department of Transportation).
4. The pavement under the tire is assumed to be unrestrained from the sides (a conservative assumption).

Analysis

The compressive strain of the pavement under the tire, ϵ, is computed as follows:

$$\epsilon = \sigma/E = 125 \text{ psi}/400{,}000 \text{ psi} = 0.00031$$

where,

σ = the compressive stress = the tire pressure
E = the modulus of elasticity.

The deflection, x, under the tire is computed as follows:

$$x = \epsilon D = (0.00031)(4.2 \text{ inches}) = 0.0013 \text{ inches}$$

where,

D = the depth of the asphalt concrete pavement.

This analysis does not take credit for the considerable amount of load distribution provided by the pavement adjacent and integral to that directly under the tire.

Asphalt Pavement Deflection Analysis (cont)

Conclusions

Under a static load, the pavement deflection would be no more than 0.0013 inches. Assuming that a dynamic load could be 10 times as large, the maximum deflection would be no more than 0.013 inches.

Analysis prepared by:

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October 6, 1992

Weather Resistance of Plasticized Polyvinyl Chloride

The *Encyclopedia of Chemical Technology*, volume 18, page 148 (Kirk-Othmer 1982) contains test data on the weather resistance of plasticized polyvinyl chloride (PVC). The test used 0.5-millimeter thick, unbacked sheet PVC containing 1 part carbon black per hundred parts rubber. The sample was continuously exposed to solar radiation at Miami, Florida. The sample was oriented to be facing due south at a 45 degree angle to the horizontal. The following results were obtained:

- Micro-Masland cold cracking at 0 °C (32 °F) (modified from ASTM D 1790-62) did not occur for 5 years
- 180 degree bend failure (cracking at room temperature) did not occur after 15 years
- final failure (severe discoloration, cracking, and tearing) did not occur after 15 years.

The above ultraviolet exposure conditions should be at least as severe as those found at the Hanford Site. Therefore, significant degradation to the berms due to weathering at the pilot plant is not expected.

Chemical Resistance of Polyvinyl Chloride

Polymer Science & Engineering, second edition, volume 9, pages 362-3 (Mark et al. 1987) contains a table titled "Resistance of Plastic Against Chemicals." This table shows that at 25 °C (77 °F), PVC generally has good chemical resistance but is subject to attack by aromatic solvents, chlorinated solvents, esters, and ketones. The 242-A Evaporator process condensate could potentially contain chemicals from all of these classes. However, there are three mitigating factors that would significantly decrease any potential chemical attack of the berm.

- The concentration of these chemicals in the 242-A Evaporator process condensate always has been very low. The combined organic contaminant level in all likelihood will be less than 100 parts per million (0.01 percent).
- The berm will be inspected daily during use and will be emptied out promptly upon detection of any liquid.
- The berm was designed for much more severe service, i.e., to provide secondary containment for aviation fuel leaks. The PVC is modified with Elvaloy (a product of the E. I. Dupont de Nemours & Company) to increase its chemical resistance.

Analysis prepared by:

D. E. Scully
Effluent Process Engineering
Westinghouse Hanford Company
April 7, 1992

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APPENDIX 4G

DECONTAMINATION PROCEDURE FOR EQUIPMENT CONTAMINATED WITH LISTED CONSTITUENTS

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Waste Water Pilot Plant Daily Inspection Checklist

Inspection Item	Yes	No	NA
1. Review the data logger printout for the last operating period. Have any operating parameters been exceeded?			
2. Are the phones functioning?			
3. Is there protective clothing for each person expected in the plant and three spare sets for emergencies and visitors?			
4. Are secondary containment pans inside the 1706-KE Building free of liquid?			
5. Are the interior floor surfaces free of cracks, gaps, and excessive wear?			
6. Is the secondary containment under the feed and receiving tankers free of liquid?			
7. Is the portable berm under the feed and receiving tankers free from tears, punctures, and excessive abrasion degradation?			
8. Is there any evidence of leaks from the tankers, piping connections, or pumps associated with the tanker trucks?			
9. Is the feed tanker pump leak detector energized?			
10. Is there any liquid in the annulus of the intermediate storage tanks?			
11. Are there any other unusual conditions?			

Comments:

Inspector ________________ / ________________ / ____________
print name signature date

Waste Water Pilot Plant Weekly Inspection Checklist

Inspection Item	Yes	No	NA
1. Has the eye wash been functionally tested in the past month? (When the test is complete sign and date the tag).			
2. Are all of the appropriate signs and labels posted and in good condition?			
3. Are all the exit signs posted and in good condition?			
4. Are all of the lights in the plant working properly?			
5. Test the ventilation system organic vapor meter with the test gas. Is it functioning correctly?			
6. Are there any other unusual conditions?			

Weekly Satellite Accumulation Inspection Checklist

Inspection Item	Yes	No	NA
1. Are the containers closed and sealed?			
2. Are there any signs of structural defect in the containers such as dents of or bulges?			
3. Are there any signs of corrosion or leaks?			
4. Is each container labeled with waste type?			
5. Is the container inventory log current and complete?			

Comments:

Inspector ____________________ / ____________________ / ________________
print name signature date

Table 5B-1. Maintenance Schedule.
(sheet 1 of 3)

Equipment number	Type	Function	Maintenance requirement
TT-tk-1,2	Process	Transports liquid waste.	Hydrostatically pressure tested every 5 years. Exterior visual inspection every year.
TT-pr-1,2	Safety	Ruptures if tanker is pressurized above operating limits.	Inspect for any visible signs of disrepair every 6 months.
TT-hv-1,2	Safety	Allows waste in the tank to be ventilated and allows the tank pressure to equalize.	Inspect for any visible signs of disrepair every 6 months.
TT-vr-1,2	Process	Protects the tank from being placed under excessive vacuum.	Inspect for any visible signs of disrepair every 6 months.
KU-lde	Safety	When moisture is detected in the unload pump catch tank, it sends a signal to the leak detection switch.	Visual inspection every 3 months during functional testing. No maintenance required.
KU-lds	Safety	When activated by a signal from the leak detector, shuts the transfer pump off.	No maintenance required.
KU-lah	Safety	Activates alarm light when the leak detector detects liquid in the secondary containment.	Verify bulb has not been burned out. Maintenance to be performed every 3 months during functional test.
KG-aa	Safety	Sends an audible signal when there is a problem in the pilot plant facility.	No maintenance required.
UV-pr	Safety	Ruptures if UV reactor pressure is above operating limit.	No maintenance required.
UV-fk-1	Safety	Senses flow in the vent line from the rupture, and shuts off power to the unit.	No maintenance required.

Table 5B-1. Maintenance Schedule.
(sheet 2 of 3)

Equipment number	Type	Function	Maintenance requirement
UV-ps	Safety	Senses high pressure in the UV reactor and shuts power off to the pump if operating limits are exceeded.	No maintenance required.
UV-pi	Safety	Monitors pressure on UV reactor feed pump discharge.	No maintenance required.
UV-TK-1,2	Safety	Senses high temperature in the UV reactor and shuts of power.	No maintenance required.
UV-ls-1	Safety	Cuts off power to UV reactor if vessel door is opened while operating.	Functional test every 6 months.
UV-ti-2	Safety	Indicates temperature of reactor water effluent.	No maintenance required.
LF-ps	Safety	Cuts off power to LERF feed pump if discharge pressure exceeds operating limits.	Visual inspection every 6 months during functional test. No maintenance required.
RO-hps-1, 2, 3	Safety	Receives signals from pressure indicators and cuts off power to RO feed pump if discharge pressure exceeds operating limits.	Visual inspection every 6 months during functional test. No maintenance required.
RO-pi-1 through 12	Safety	Monitors feed RO feed pump discharges.	No maintenance required.
PH-ls	Process	Sends a signal to the control valve to shut off flow pH tank liquid level is too high.	Visual inspection with functional test every 3 months. No maintenance required.
PH-lah	Safety	Energizes a visible alarm light when liquid level in the pH tank is too high.	Visual inspection. Verify bulb has not been burned out. Maintenance to be performed with PH-ls every 3 months.

1 Table 5B-2. Calibration Schedule.
2 (sheet 1 of 3)

	Equipment number	Type	Function	Calibration requirement
4 5				
6	KU-lde	Safety	When moisture is detected in the unload pump catch tank, it sends a signal to the leak detection switch.	Functional test every 3 months, no calibration required.
7	KU-lds	Safety	When activated by a signal from the leak detector, shuts the transfer pump off.	Functional test with KU-lde every 3 months, no calibration required.
8	KU-lah	Safety	Activates alarm light when the leak detector detects liquid in the secondary containment.	Functional test with KU-lde every 3 months, no calibration required.
9	KG-aa	Safety	Sends an audible signal when there is a problem in the pilot plant facility.	Functional test every 3 months, no calibration required.
10	UV-fk-1	Safety	Senses flow in the vent line from the rupture, and shuts off power to the unit.	Functional test every 6 months.
11	UV-ps	Safety	Senses high pressure in the UV reactor and shuts power off to the pump if operating limits are exceeded.	Functional check using line pressure every 6 months.
12	UV-pi	Safety	Monitors pressure on UV reactor feed pump discharge.	Vendor calibrated. No calibration required.
13	UV-TK-1,2	Safety	Senses high temperature in the UV reactor and shuts of power.	Functional check every 6 months by immersing the sensors in 150 degree water bath. Frequency: Every 6 months.

Table 5B-2. Calibration Schedule.
(sheet 2 of 3)

	Equipment number	Type	Function	Calibration requirement
1	UV-ti-2	Safety	Indicates temperature of reactor water effluent.	Multipoint calibration against a certified temperature indicator, or, replace with a calibrated temperature indicator. Frequency: every 6 months.
2	LF-ps	Safety	Cuts off power to LERF feed pump if discharge pressure exceeds operating limits.	Functional test every 6 months.
3	RO-hps-1,2	Safety	Receives signals from pressure indicators and cuts off power to RO feed pump if discharge pressure exceeds operating limits.	Functional test every 6 months.
4 5	RO-pi-3, 6, 12	Safety	Monitors RO high-pressure feed pump discharges.	Multipoint calibration against a certified pressure indicator, or, replace with calibrated pressure indicator(s). Frequency: Every 6 months.
6	PH-ls	Process	Sends a signal to the control valve to shut off flow, pH tank liquid level is too high.	Functional test every 3 months.
7	PH-lah	Safety	Energizes a visible alarm light when liquid level in the pH tank is too high.	Functional test with PH-ls every 3 months.
8	VV-hepa	Safety	Removes particulates from vent stream.	DOP test annually.

Table 5B-2. Calibration Schedule.
(sheet 3 of 3)

	Equipment number	Type	Function	Calibration requirement
1	VV-dpis	Safety	When the differential pressure exceeds the operating limits the switch sends a signal to the high or low pressure visible alarms.	Functional test annually. No calibration required.
2	VV-dpah	Safety	Energizes a visible alarm when HEPA filter pressure is too high.	Functional test annually. No calibration required.
3	VV-dpal	Safety	Energizes a visible alarm when HEPA filter pressure is too low.	Functional test annually. No calibration required.
4	VV-ps	Safety	When the pressure of the vent header is too low the switch sends a signal to the visible low pressure alarm.	Functional test annually. No calibration required.
5	VV-pal	Safety	Energizes a visible alarm when vent header pressure is too low.	Functional test annually. No calibration required.

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Table 5B-3. Critical Equipment List.
(sheet 1 of 2)

Equipment number	Unit operation	Item description
TT-tk-1,2	waste transfer	trailer tanks
TT-pr-1,2	waste transfer	rupture disk on trailer tanks
TT-hv-1,2	waste transfer	vent valves on trailer tanks
TT-vr-1,2	waste transfer	vacuum relief devices on trailer tanks
LL-cb	waste load/unload	catch basin at LERF
KU-cb-1	waste unload	inflatable berm at 1706-KE unload station
KU-cb-2	waste unload	catch tank under unload pump at 1706-KE
KU-lde	waste unload	leak detector element for unload pump catch tank at 1706-KE
KU-lds	waste unload	leak detector switch for unload pump catch tank at 1706-KE
KU-lah	waste unload	visible alarm for high level in unload pump catch tank at 1706-KE
KG-aa	several	general audible alarm at 1706-KE
KL-cb	waste load	inflatable berm 1706-KE load station
UV-pr	uv/ox	rupture disk on reactor vessel
UV-fk-1	uv/ox	flow switch on vent line
UV-ps	uv/ox	pressure switch on feed pump discharge
UV-pi-1	uv/ox	pressure indicator on feed pump discharge
UV-TK-1,2	uv/ox	high temperature switches on reactor vessel
UV-ti-2	uv/ox	Indicates temperature of reactor water effluent.
UV-ls-1	uv/ox	limit switch on reactor vessel door

Table 5B-3. Critical Equipment List.
(sheet 2 of 2)

Equipment number	Unit operation	Item description
LF-ps	LERF filtration	high-pressure switch on feed pump discharge
RO-hps-1,2,3	reverse osmosis	high-pressure switches on feed pump discharges
RO-pi-3, 6, 12	reverse osmosis	pressure indicators on feed pump discharges
PH-ls	pH adjustment	limit switch on pH adjustment tank liquid level
PH-cv	pH adjustment	control valve on waste water feed line
PH-lah	pH adjustment	high-liquid level visible alarm
VV-hepa	vessel vent	HEPA filters for the 1706-KE vessel ventilation system
VV-dpis	vessel vent	differential pressure indicating switch for 1706-KE HEPA filters
VV-dpah	vessel vent	high differential pressure visible alarm for 1706-KE HEPA filters
VV-dpal	vessel vent	low differential pressure visible alarm for 1706-KE HEPA filters
VV-ps	vessel vent	low pressure switch for vessel vent header
VV-pal	vessel vent	low pressure visible alarm for 1706-KE vessel vent header

APPENDIX 6A

HANFORD FACILITY CONTINGENCY PLAN

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HANFORD FACILITY CONTINGENCY PLAN

CONTENTS

CONTENTS (cont)

FIGURES

TABLES

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1.0 GENERAL INFORMATION

The Hanford Facility is defined as a single *Resource Conservation and Recovery Act* (RCRA) *of 1976* facility, identified by the EPA/State Identification Number WA7890008967, that consists of over 60 treatment, storage, and/or disposal (TSD) units conducting dangerous waste management activities. The Hanford Facility consists of the contiguous portion of the Hanford Site that contains these TSD units and, for the purposes of RCRA, is owned and operated by the U.S. Department of Energy (excluding lands north and east of the Columbia River, river islands, lands owned by the Bonneville Power Administration, lands leased to the Washington Public Power Supply System, and lands owned by or leased to the state of Washington).

2.0 EMERGENCY COORDINATORS

The overall responsibility for implementation of this Hanford Facility Contingency Plan (Plan) lies with the building emergency director (BED) or their designated alternates. The BED has the responsibilities of the Emergency Coordinator as named in the Washington State Department of Ecology (Ecology), *Dangerous Waste Regulations*, Washington Administrative Code (WAC) 173-303-360. A list of all BEDs and alternates is maintained at various locations throughout the Hanford Facility, and these individuals can be reached 24 hours per day. The BEDs have the authority to commit all necessary resources (both equipment and personnel) to respond to any emergency. Additional responsibilities have been delegated to the Hanford Fire Department personnel who are authorized to act for the BED when the BED is absent. These Hanford Fire Department personnel have the authority to commit all necessary resources (both equipment and personnel) to respond to any emergency.

Response by a BED (or an Emergency Coordinator) usually is obtained through the DOE-RL single point-of-contact* by dialing telephone number 811 or 373-3800 or 375-2400. The single point-of-contact has been designated as the contact point to mobilize a response to any Hanford Facility emergency. The single point-of-contact is available at all times and has the responsibility to initiate notifications to the BED or alternate to begin responses to emergencies, as well as to dispatch emergency responders (Hanford Fire Department, Hanford Patrol, or ambulance services). All emergency notifications to the BED, building managers, etc., can be made directly from the affected TSD unit or through the single point-of-contact.

The unit-specific DOE-RL technical contact responds to regulatory agency inquiries regarding this Plan. The DOE-RL technical contacts are accessed by contacting 373-3800 or 375-2400.

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*The single point-of-contact is the Hanford Patrol Operations Center (811 or 373-3800) and/or the Pacific Northwest Laboratory Security Center (375-2400).

3.0 IMPLEMENTATION OF THE CONTINGENCY PLAN

The decision by the BED to implement the Plan depends on whether an incident in progress has the potential to threaten human health or the environment. After being notified of an emergency, the BED proceeds to the section and evaluates the situation. Based on the evaluation of the event, the BED will implement the actions described in this Plan to the extent necessary to protect human health and the environment.

Incidents that pose a potential threat to human health and/or the environment discovered by TSD unit personnel require immediate notification of the BED and the Hanford Fire Department. Personnel may respond, in accordance with the procedures given in TSD unit-specific contingency plans, before the arrival of the BED, as long as such response is within their level of training. The Hanford Fire Department is contacted on all dangerous materials or mixed waste incidents as the designated incident command agency.

4.0 EMERGENCY RESPONSE PROCEDURES

Emergency response procedures have been established for each specific TSD unit. The initial response to any emergency will be to immediately protect the health and safety of persons in the immediate area. Identification of released material is essential to determine appropriate protective actions. Containment, treatment, and disposal assessment will be the secondary responses.

The following sections describe emergency actions for personnel for several different types of emergencies that might occur on the Hanford Facility.

4.1 EVENT CATEGORIZATION AND NOTIFICATION

There are three categories of incidents on the Hanford Facility: offnormal event, unusual occurrence, and emergency. A description of these categories is contained in Table 1 and implemented through the DOE-RL's and contractors' procedures.

Incidents are categorized based on degradation of TSD-unit safety systems and impact to other TSD units, employees, structures, public safety, and the environment. Incidents categorized as offnormal events and unusual occurrences are communicated to Ecology as described in Section 10.0.

Those incidents that are categorized as Emergencies are further classified into one of three levels: Alert, Site Area Emergency, and General Emergency. The criteria for Alert, Site Area, and General Emergency also are described in Table 1. Incidents that are classified into one of the emergency classes also are communicated to onsite and offsite personnel and agencies as described herein and in Section 10.0. Notifications are made according to the

Table 1. Hanford Facility Incident Categorization.

Categorization	Event definition/description
Emergency class and protective action recommendation	Emergency classification criteria (DOE Order 5500.1B)
General emergency	Events in progress or that have occurred involving actual or imminent catastrophic failure of safety systems with potential for loss of confinement integrity, catastrophic degradation of protection systems, or catastrophic failure in safety or protection systems. Any environmental release of hazardous material reasonably can be expected to exceed the appropriate protective action guides off the Hanford Facility.
Facility area emergency	Events that are in progress or that have occurred involving actual or likely major failures of safety systems needed for protection of onsite personnel, health and safety of the public, or the environment. Any environmental releases of hazardous material are not expected to exceed the appropriate protective action guides offsite.
Alert	Events in progress or that have occurred involve an actual or potential substantial reduction for the level of TSD unit safety and protection. Any environmental release of hazardous materials is expected to be limited to a small fraction of the appropriate protective action guidelines or emergency response planning guideline on the Hanford Facility.
Nonemergency category	DOE Order 5000.3A criteria (nonemergency)
Unusual occurrence	Nonemergency event that has significant potential for impact on safety, environment, health, security, or operations of a TSD unit.
Offnormal event	Nonemergency event that adversely affects or is indicative of degradation of safety, security, environmental, or health protection performance or operation of a facility.

DOE = U.S. Department of Energy.
DOE-HQ = U.S. Department of Energy - Headquarters.

type of incident and the impact of that incident, as described in the following sections.

4.1.1 Discoverer

If within the TSD unit, the discoverer takes the following actions.

1. Notifies TSD unit personnel (including the BED if on site) of the incident.

2. Immediately notifies the single point-of-contact (811* or 375-2400) and provides all known information, if the information can be obtained without jeopardizing personnel safety, including the following:

   - Name(s) of chemical(s) involved and amount(s) spilled, on fire, or otherwise involved, or threatened by, the incident

   - Name and callback telephone number of person reporting the incident

   - Location of incident (identify as closely as possible)

   - Time incident began or was discovered

   - Where the materials involved are going or might go, such as into secondary containment, under doors, through air ducts, etc.

   - Source and cause, if known, of spill or discharge

   - Name(s) of anyone contaminated or injured in connection with the incident

   - Any corrective actions in progress

   - Anyone else who the discoverer has contacted.

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*The DOE-RL and other contractor personnel are trained to notify the Hanford Emergency number (811 from onsite telephones and 375-2400 from 375 prefix telephones) for immediate dispatch of the Hanford Fire Department for fire, ambulance services, hazardous materials/mixed waste response, and for the Hanford Patrol. Hanford Patrol, who operates the 811 number, and Pacific Northwest Laboratory Security, who operates the 375-2400, notify other organizations and contractors to ensure appropriate actions are taken.

4.1.2 Single Point-of-Contact

The single point-of-contact takes the following actions:

1. Initiates notification to the BED, or one of the alternates if the BED cannot be reached immediately, to arrange immediate response to the incident

2. Requests immediate response from the Hanford Fire Department for fire, ambulance service, and/or hazardous materials/mixed waste incidents

3. Contacts the Hanford Patrol for traffic control and security measures, as needed, based on the report of the discoverer

4. Initiates notification to appropriate management of the spill or release incident

5. Supports the BED in providing further notification and coordination of response activities if needed. Activities that might require participation are as follows:

   - Activates or requests activation of the appropriate alarm signals (as required) for the affected building or affected 200, 300, or 400 Areas, when the BED determines that protective actions are necessary

   - Notifies the emergency response organizations

   - Activation of the affected area emergency control centers (ECC) if requested by the BED or other authorized persons

   - Activation of the DOE-RL Emergency Action and Coordinating Team (EACT), if necessary, to recommend protective actions for areas outside the Hanford Facility.

4.1.3 Building Emergency Director (or alternate)

The BED, acting as the Event Commander (Emergency Coordinator), performs the following:

1. Sounds appropriate alarms to notify occupants

2. Notifies the single point-of-contact if additional support or an area evacuation is needed

3. Activates the building emergency response organization as necessary

4. Arranges for care of any injured employees

5. Requests the single point-of-contact to activate the affected ECC, if required. Activation of the ECC should be done whenever technical assistance is required in evaluating a spill, when the emergency might affect neighboring buildings, or when otherwise deemed necessary by the BED. Refer to Section 4.1.4.

6. Provides for event notification in accordance with DOE Order 5000.3A and other established Hanford Facility procedures

7. Provides details of the incident to appropriate management as the details become available.

4.1.4 Hanford Facility Emergency Control Centers

The ECCs are those locations staffed to provide assistance to building emergency organizations in an emergency situation. The ECCs are established to support and to provide overall direction of emergency events occurring at locations within their geographic area of responsibility, within the Hanford Facility. This includes acquisition of and assignment of resources to respond to emergency events. Responsibilities also include personnel protection (employee and public), TSD unit safety, and environmental protection. The establishment of ECCs ensures that notification and communication of emergency conditions are communicated properly.

There are six ECCs located throughout the Hanford Facility and Hanford Site (Table 2).

4.1.5 Release Notifications

The DOE-RL actions include notification of releases to the National Response Center and to Ecology in accordance with Section 10.0 (i.e., whenever required by federal or state regulations).

4.2 IDENTIFICATION OF HAZARDOUS MATERIALS AND DANGEROUS WASTE

The BED ensures that trained personnel identify the character, source, amount, and extent of the hazardous material or dangerous waste involved in the incident to the extent possible. Identification of waste can be made by visual inspection of involved containers; by sampling; by reference to inventory records, shipping manifests, or waste tracking forms; or by consulting with TSD unit operations personnel. Samples of materials involved in an emergency might be analyzed as appropriate.

4.3 HAZARD ASSESSMENT

Once the material or waste involved in the incident has been identified, the extent of the danger posed by the incident is determined. The BED or alternate ensures that both direct and indirect hazards are assessed.

Table 2. Emergency Control Centers.

Emergency Control Center	Responsibility
Northern Area Emergency Control Center Location: 2750-E, 200 East Area	Geographic area of responsibility: All 100 and 200 Areas plus the 600 Area north of the WYE Barricade bounded by the Columbia River and Highway 240.
300 Area Emergency Control Center Location: 3701-D, 300 Area	Geographic area of responsibility: 300, 700, 1100 and 3000 Areas plus the 600 Area south of the WYE Barricade bounded by the Columbia River and Highway 240.
400 Area Emergency Control Center Location: Fast Flux Test Facility, 400 Area	Geographic area of responsibility: 400 Area.
3000 Area Emergency Control Center Location: Pacific Northwest Laboratory Materials Reliability Center Building	Geographic area of responsibility: All Pacific Northwest Laboratory buildings located in the 300, 700, 1100, and 3000 Areas.
Emergency Management Center Location: 1170 Building	Responsible for the remaining 600 Area not covered by the area ECCs, assisting area ECCs, coordinating the Facility-wide response to emergencies, and serving as the focal point for other Hanford Site contractors and DOE-RL during emergencies.
DOE-RL Emergency Control Center Location: Federal Building, Richland	Responsible for providing overall direction for all Hanford Facility emergency situations involving the DOE-RL and/or contractor personnel, ensuring direct interface with all offsite agencies for mitigation and protection of offsite populations, facilities, and the environment.

The ECC is available to assist the BED if needed. Possible assistance could be in determining the extent of an emergency, identifying the hazards associated with the materials or waste involved in the incident, assisting in response to the incident, or coordinating the mobilization of special equipment or supplies to the incident site.

If assessment of all available information does not yield a positive assessment of the danger posed by the incident, a worst-case condition will be presumed and appropriate protective actions will be initiated. The BED is responsible to initiate any protective actions through the steps shown in Section 4.1.

4.4 EVACUATION PROCESS

(Signal: Steady siren) In the event of an area-wide evacuation, personnel shut down equipment, secure waste (especially mixed waste), and secure classified documents (or carry the documents with them) if time permits. Personnel report to designated staging areas and conduct personnel accountability. The BED directs this accountability for all personnel involved in evacuating the immediate structures or areas.

Figure 1 shows the site evacuation routes available for the Hanford Facility. Specific routes used will be determined at the time of the event based on event magnitude, location, and meteorology.

4.5 TAKE COVER

(Signal: Wavering siren) In the event of a take cover alarm, personnel remain inside, close all exterior doors, and turn off all intake ventilation. Personnel secure all waste and classified documents.

4.6 RESPONSE TO MINOR SPILLS OR RELEASES

(Signal: None) The TSD unit personnel generally perform immediate cleanup of minor spills or releases using sorbents and emergency equipment noted in Section 5.0. Personnel detecting such spills or releases contact the single point-of-contact to notify of the detection of such release and to ensure notification of the BED and the Hanford Fire Department. Responses to spills or releases occurring within individual storage cells, structures, modules, etc., during routine handling and storage are contained in TSD unit-specific contingency plans.

A spill or release of hazardous material or dangerous waste is considered 'minor' if <u>all</u> of the following are true:

- The spill does not threaten the health and safety of occupants of the building, i.e., an evacuation is not necessary

9 1 1 1 3 1 1 1 7 8

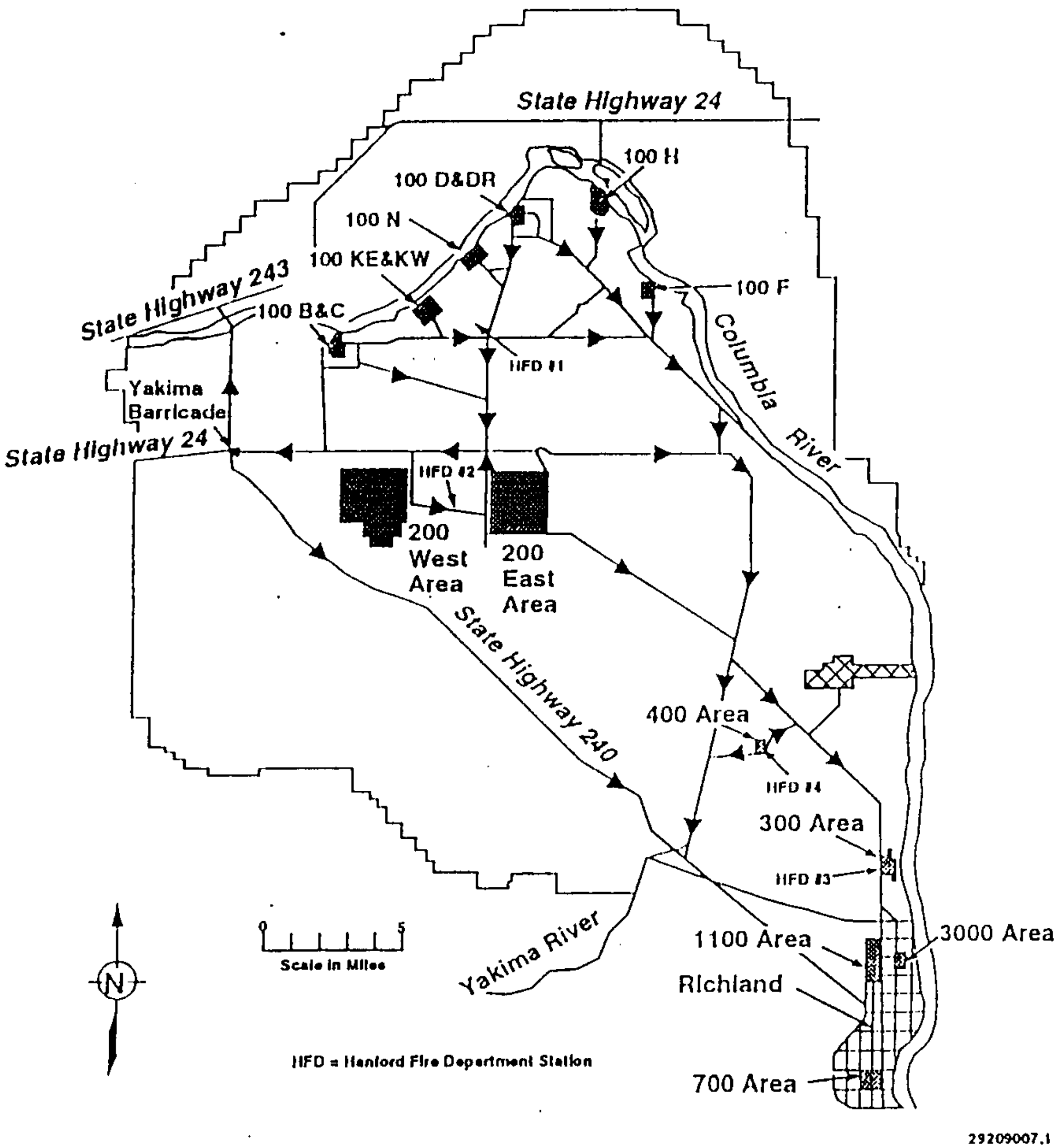

Figure 1. Hanford Facility Evacuation Routes.

- The spill is small in size (generally less than half of the immediately dangerous to life and health quantities identified in material safety data sheets)

- The composition of the material or waste is known or can be quickly determined from label, manifest, material safety data sheets, or disposal request information.

If one or more of the foregoing conditions are not met, responses are performed as described in Section 4.7. Notification of the spill takes place as described in Section 4.1.

4.7 MAJOR DANGEROUS WASTE AND/OR MIXED WASTE SPILL OR MATERIAL RELEASE

(Signal: None) The following actions are taken in the event of a major release.

4.7.1 Discoverer

The discover performs the following:

1. If within the TSD unit, notify personnel (including BED) of discovery of spill or release by sounding the appropriate alarm, using the public address (PA) system, etc.

2. Initiate notifications to the Hanford Fire Department (and BED if necessary) by contacting the single-point contact and provide all known information, in accordance with Section 4.1.I

3. Takes action to contain and/or to stop the spill if all of the following are true:

   - The identity of the substance(s) involved is known

   - Appropriate protective equipment and control/cleanup supplies are readily available

   - Discoverer can safely perform the action(s) without assistance, or assistance is readily available from other trained TSD unit personnel.

If any of the above conditions are not met, or there is any doubt, the discoverer evacuates the area and remains outside, upwind of the TSD unit, pending the arrival of the BED. The discoverer remains available for consultation with the BED, Hanford Fire Department, or other emergency response personnel.

4.7.2 Single Point-of-Contact

The single point-of-contact performs the following:

1. Notifies the Hanford Fire Department and relays information received from the event scene

2. Initiates notification to the BED if not at the TSD unit

3. Remains available to support further notification and response activities if needed.

4.7.3 Building Emergency Director

The BED performs or arranges for the following:

1. Proceeds directly to the TSD unit to coordinate further activity and to establish a command post at a safe location

2. Obtains all available information pertaining to the incident

3. Determines need for assistance from agencies listed in Section 6.0 and arranges for their mobilization and response through the single point-of-contact

4. If building or area evacuation is necessary, initiates the appropriate alarm

5. Arranges for care of any injured persons

6. If a threat to surrounding buildings or structures exists, requests activation the affected area ECC via the single-point of contact

7. Provides for event notification in accordance with Section 4.1

8. Maintains access control at the incident site by keeping unauthorized personnel and vehicles away from the area. Security personnel can be used to assist in site control if control of the boundary is difficult (e.g., repeated incursions). In determining controlled access areas, considers environmental factors such as wind velocity and direction

9. Arranges for proper remediation of the incident after evaluation, in accordance with Sections 4.2 and 4.3

10. Remains available for fire, patrol, and other authorities on the scene and provides all required information

11. If around-the-clock work is anticipated, enlists the assistance of alternate BED(s)

12. Refers media inquiries to the Media Relations/Communications offices of the contractors or DOE-RL.

13. If remediation is performed by TSD unit personnel, ensures the use of proper protective equipment, remedial techniques (including ignition source control for flammable spills), and decontamination procedures by all involved personnel. Areas of expertise are available in determining necessary equipment or procedures

14. Remains at the scene to oversee activities and to provide information, if remediation is performed by the Hanford Fire Department Hazardous Materials Response Team or other response teams

15. Ensures proper containerization, packaging, and labeling of recovered spill materials and overpacked containers

16. Ensures decontamination (or restocking) and restoration of emergency equipment used in the spill remediation before resuming TSD unit operations

17. Provides required reports after the incident in accordance with Section 10.0.

4.7.4 Hanford Fire Department Response to Unknown Spills

The Hanford Fire Department response to unknown spills is as follows.

1. Initial Hanford Fire Department response includes one engine company, one hazardous materials unit, one ambulance unit, and one battalion commander.

2. The Hanford Fire Department, as the Hazardous Materials Incident Command Agency, establishes command and control of the situation. The first arriving unit assumes incident command and determines location of the command post, and evacuates personnel from a red zone consisting of a minimum of 100 feet (30.5 meters) in all directions. Red zone could be adjusted as deemed necessary by the hazardous materials team leader.

3. Evacuates all personnel within the red zone area.

4. Hazardous materials team leader establishes yellow zone and decontamination corridor.

5. Hazardous materials team leader assigns fully trained and qualified team members specific tasks i.e.,

Team Safety Officer	Decontamination Team Leader
Entry Team	Resource Leader
Backup Team	Science Leader

6. Hazardous materials team safety leader controls and directs the medical evaluations for personnel working in the red and the yellow zones.

7. Team members performing entry, back up, and decontamination, suit up in level "A" protection.

8. Entry team members make entry to obtain sample of unknown hazardous material, and observe for other pertinent information.

9. Entry team collects sample and exits area going through decontamination by decontamination team.

10. Hazardous materials sample is analyzed on scene by hazardous materials team personnel using available testing equipment. This testing is to determine hazard group classification i.e., poison, acid, flammable, oxidizer, etc.

11. Once hazard classification has been identified, hazardous materials entry team makes re-entry to stabilize and control hazardous material to the point that the emergency no longer exists.

12. Entry team exits area going through decontamination by decontamination team.

13. Spill site is turned over to cleanup personnel for cleanup and disposal.

14. Hazardous materials response command is dissolved; all units return to stations.

15. Critique of hazardous materials incident is held with team members as soon as possible after Hanford Fire Department units have returned to stations.

4.8 RESPONSE TO FIRE

(Signal: Gong) In the event of a fire, the discoverer activates a fire alarm and calls the single point-of-contact. Automatic initiation of a fire alarm (through the smoke detectors and sprinkler systems) also is possible. The TSD unit personnel are trained in the use of portable fire extinguishers for incipient fires. Personnel use their best judgment whether to fight a fire or to evacuate. Under no circumstances do personnel remain to fight a fire if unusual hazards exist.

The following actions are taken in the event of a fire or explosion.

1. On actuation of the fire alarm, personnel shut down equipment, secure waste (especially mixed waste), and lock up classified documents (or carry the documents with them), ONLY if time permits.

The alarm automatically signals the Hanford Fire Department and the Hanford Patrol Operations Center.

2. Personnel leave the area/building by the nearest safe exit and proceed to the designated staging area for accounting.*

3. The single point-of-contact is notified immediately, who in turn initiates notifications to the BED (or alternate) if necessary.

4. The BED proceeds directly to the scene (if not already there).

5. The BED obtains all necessary information pertaining to the incident.

6. Depending on the severity of the event, the BED (or lead Facility Manager) contacts the Occurrence Notification Center and requests additional notifications to offsite agencies (e.g., Ecology, local counties, and DOE-Headquarters), informing them as to the extent of the emergency (including estimates of dangerous waste or mixed waste quantities released to the environment) and any actions necessary to protect nearby buildings and/or structures.

7. Depending on severity, the BED requests activation of the affected area ECC to establish organizations to provide assistance from the DOE-RL, other Hanford Facility contractors, and outside agencies.

8. The Hanford Patrol establishes roadblocks within the area to route traffic away from the emergency scene.

9. Hanford Fire Department medical personnel remove injured personnel to a safe location, apply first aid, and prepare the injured for transport to medical aid stations or to local hospitals in accordance with established agreements (copies of the agreements are maintained by the Hanford Fire Department). Medical personnel are on standby at the fire stations 24 hours per day.

10. Hanford Fire Department firefighters extinguish the fire.

11. All emergency equipment is cleaned and fit for its intended use following completion of cleanup procedures.

4.9 UNUSUAL, IRRITATING, OR STRONG ODORS

(Signal: None) If an unusual, irritating, or strong odor is detected, and the discoverer has reason to believe that the odor might be the result of

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*Nuclear or nuclear reactor facilities are not required to evacuate upon sound of a fire alarm but are provided supplemental information via building notification systems relative to evacuations.

an uncontrolled release of a toxic or dangerous material, the discoverer performs the following:

- Activates the building evacuation alarm or fire alarm system to evacuate the building

- Notifies the single point-of-contact, the building manager, and cognizant line management.

If the discoverer knows of the source and scope of the release, this information is reported quickly to the BED. Measures are taken to contain the release and ventilate the area, if safe and advisable to do so.

If an unusual odor is detected within the building or structure, and the source of the odor is unknown, the BED considers additional protective actions.

4.10 CRIMINAL ACTIVITY

(Signal: None) If sabotage, threatened action, or a bomb or suspicious object is discovered, TSD unit personnel clear the affected area. The single point-of-contact, the BED, and the Hanford Patrol are notified. Personnel take whatever steps are necessary to ensure that suspicious objects are not moved, opened, or otherwise disturbed. If practicable and safe to do so, place warning signs, barricades, or guards to protect the object pending the arrival of qualified personnel.

4.11 OFF-SHIFT CONDITIONS

(Signal: None) If personnel are working outside normal working hours and the need to evacuate the building or area occurs, the following actions will be performed by the BED:

- The BED ensures that all persons in the area/building leave through the nearest safe exit; provide assistance if necessary

- Follow the evacuation procedure (Section 4.4.1)

- In case of fire, activate the fire alarm and leave the building and/or area

- Notify the single point-of-contact and the Hanford Fire Department

- Stay in a safe place nearby and inform the responding Hanford Fire Department personnel of the nature and location of the emergency.

4.12 POWER FAILURE

(Signal: None) In the event of power failure, all containers of waste are checked for closure and returned to their storage areas if necessary. Equipment not related to services is shut down to allow orderly restoration of power. Essential equipment that should remain operational consists of building ventilation systems and monitoring and sampling systems.

In a power failure, the building manager and the BED are to be notified. The building manager arranges for restoration of power service to the building/area. The BED evaluates whether the Plan should be implemented as described in Section 3.0 and whether protective actions are required. If the Plan is not implemented, personnel could be required to monitor the area for continuing release potential during extreme temperature periods. The BED determines the need for, and extent of, any such monitoring, in consultation with an industrial hygienist if appropriate.

In the event of power loss to equipment, which results in failure of the equipment, the building manager is to be contacted to arrange for repair of the affected equipment, to arrange for a fire watch, and/or to provide for restoration of power. The BED should be contacted if any failure results in a release or potential release to the environment as described in Section 3.0.

4.13 RESPONSE TO CONTAINER SPILLS OR LEAKS

In addition to the foregoing Plan provisions, the following specific actions could be taken for leaks or spills from containers at the TSD units. These actions may be taken only by appropriately trained personnel.

- Container leaks are stopped as soon as possible using appropriate procedures. Appropriate personnel protective equipment is used.

- If it is inadvisable to approach the container, absorbent materials are used, and access is restricted pending notification of the BED and implementation of the Plan.

- Contents of leaking containers could be transferred to appropriate nonleaking containers. Transfer procedures for fire safety are followed for ignitable or reactive waste (e.g., use of nonsparking tools, bonding and grounding of containers, isolation of ignition sources, and use of explosion-proof electrical equipment).

- Overpacked containers are marked and labeled in the same manner as the contents. All containers of spill debris, recovered product, etc., are managed in the same manner as waste containers received from outside the TSD unit. Overpacks in use at the TSD unit are marked with information pertaining to their contents and noted as to whether the container inside the overpack is leaking or is in good condition.

4.14 RESPONSE TO TRANSPORTATION AND/OR PACKAGING INCIDENTS

This section describes the actions taken in the event of an unplanned sudden or nonsudden release of dangerous waste or dangerous waste constituents to air, soil, surface water, or groundwater during onsite transportation activities, or at locations not covered by a unit-specific contingency plan. This includes spills or releases as a result of transportation activities, movement of materials, packaging, and storage of hazardous materials.

The following steps are performed by those individuals responding to a hazardous materials transportation incident at the Hanford Facility.

4.14.1 Initial Responder Actions

The initial responder or discoverer of a hazardous materials spill or release resulting from onsite transportation activities initiates the following response actions, if the actions can be performed without jeopardizing personnel safety, as appropriate.

- Determines the nature of incident
  - Personnel injuries
  - Hazardous material spill with fire
  - Hazardous material spill without fire.
- Assist injured personnel.
- Initiate notifications to the single point-of-contact by any means available (telephone, radio, passing motorist, etc.) to request assistance from the Hanford Fire Department (Emergency Coordinator for these type of events), Hanford Patrol and medical personnel.
- Remain in a safe location and attempt to isolate the area to prevent inadvertent personnel access.

4.14.2 Event Commander--Outside Treatment, Storage, and/or Disposal Units

If the emergency event is located within the responsibility of a BED, the BED will establish event command.

The Hanford Fire Department will establish and maintain incident command on arrival at the emergency event. The Incident Commander will perform or coordinate the event command actions for locations not controlled by a BED.

The Event Commander will ensure that the cause of the incident and its possible effects are investigated and evaluated as soon as possible. The Event Commander, with input from the Incident Commander,assesses possible hazards to human health and the environment (considering direct, indirect, immediate, and long-term affects) that might result from the release, fire, or explosion and takes the following actions as appropriate:

- Isolate from employees:
  - Cordon off access
  - Place apparatus to block roadways
  - Use Hanford Patrol roadblocks
  - Use unit/vehicle PA systems
  - Sound appropriate alarms.

- Determine type of hazardous materials involved:
  - Occupancy/location
  - Container shapes
  - Markings and colors
  - Placards and labels
  - Shipping papers
  - Consult reference materials (U.S. Department of Transportation, National Institute of Occupational Safety and Health *Pocket Guide to Chemical Hazards*)
  - Unit managers/employees.

- Notify the appropriate manager of the incident and ensure that the incident is reported properly in accordance with Section 10.0 of this Plan

- If the TSD unit stops operations in response to a fire, an explosion, or a release, the BED will monitor for leaks, pressure buildup, gas generation, or ruptures in valves, pipes, or other equipment, wherever this is appropriate

- Coordinate with emergency response organizations to establish a command post, upwind and uphill of the incident:
  - Ensure command post is located so as to minimize the need for relocation
  - Direct incoming response vehicles to a safe staging area
  - Coordinate tasks with other responders
  - Activate required emergency centers
  - Dispatch radiological and nonradiological field teams to help define and locate the plume.

- Rescue/evacuation can be performed by trained personnel, other than the Hanford Fire Department, if the victim's location could present an immediate life-threatening situation or further injuries to the victim. Ensure that all personnel who enter the area are equipped with proper protective clothing and respiratory protection
  - Rescue should <u>only</u> be attempted when the risks have been evaluated and are considered acceptable.
  - If the risks are unknown, or considered unacceptable, wait for the Hazardous Material Response Team.

- Complete other actions necessary to effect control of the scene, including but not limited to the following:

  NOTE: The following steps normally are conducted and/or directed by a Hanford Fire Department Hazardous Materials Response Team leader.

- Secure the scene
- Use absorbents
- Use covering (blankets, polyethylene, etc.)
- Overpack
- Plug/patch
- Transfer to new container
- Venting/vapor suppression.

• Initiate other measures as needed, including but not limited to, the following:
  - Place hose streams and unmanned monitors
  - Establish confinement dikes to prevent run-off
  - Perform first aid.

• Obtain additional information:
  - Who is operating the equipment
  - What and how much hazardous material is involved
  - Manufacturer, shipper, receiver
  - Weather conditions.

• Set up resource areas:
  - Command post location
  - Logistics area
  - Triage area
  - Decontamination area (personnel and equipment)
  - Staging area
  - Planning.

• Reevaluate evacuation boundaries and identify containment zones to adequately protect responding personnel

• Additional actions to be taken to mitigate the incident might include the following:
  - Cool tanks involved in a fire or exposed to heat to reduce the potential for explosion
  - Remove all available ignition sources
  - Divert liquid and run-off water to prevent contamination spread
  - Dike and retain liquids from a leak or spill
  - Limit property damage as much as possible
  - Provide on-scene emergency medical services.

• Document the response to the incident and provide a report to appropriate management

• Following an emergency incident and on completion of the emergency response to that incident, the Emergency Coordinator and/or BED conducts a critique, including cause(s), impact(s), and lesson(s) learned from the incident. The Emergency Coordinator and/or BED ensures that all appropriate parties are aware of, and participate in, decisions on the best course(s) of action to take to prevent or minimize the possibility of future occurrences. Specific steps are described in Section 4.5.

4.15 DAMAGED, UNACCEPTABLE SHIPMENTS

(Signal: None) When a damaged shipment of hazardous material or dangerous waste arrives at a TSD unit and the shipment is unacceptable for receipt, the damaged shipment should not be moved. The TSD unit personnel instead perform the following steps.

- If the release from damaged package is a 'minor' spill under the criteria of Section 4.6, the following actions are performed.
  - Notify the BED, the Hanford Fire Department, and the single point-of-contact to advise of the situation. The BED responds and assists in the evaluation of, and response to, the incident.
  - The generating unit is notified of the damaged shipment and provides any chemical information necessary to assist in responding to the 'minor' spill.
  - TSD unit personnel proceed with remedial action, including overpacking damaged containers, cleanup of spilled material, or other necessary actions to contain the spill.

- If the release does not meet the criteria of a 'minor' spill as noted previously, or the extent of the spill cannot be determined, the TSD unit contingency plan is implemented.

4.16 PREVENTION OF RECURRENCE OR SPREAD OF FIRES, EXPLOSIONS, OR RELEASES

The BED, in coordination with emergency response organizations, takes the steps necessary to ensure that a secondary release, fire, or explosion does not occur. The following actions are taken:

- Isolate the area of the initial incident by shutting off power, closing off ventilation systems, etc., to minimize the spread of a release and/or the potential for a fire or explosion

- Inspect containment for leaks, cracks, or other damage

- Inspect for toxic vapor generation

- Remove released material and waste remaining inside of containment structures as soon as possible

- Contain and isolate residual waste material using dikes and adsorbents

- Cover or otherwise stabilize areas where residual released materials remain to prevent migration or spread from wind or precipitation run-off

- Install new structures, systems, or equipment to enable better management of hazardous materials or dangerous waste

- Reactivate adjacent operations in affected areas only after cleanup of residual waste materials is achieved.

4.17 STORAGE AND TREATMENT OF RELEASED MATERIAL

Following stabilization of the event, the BED or the recovery organization arranges for the cleanup phase. Released material and contaminated debris are treated, stored, and/or disposed of in an appropriate manner.

These materials are managed in the same manner as waste received from outside the TSD unit. All waste so generated is containerized in drums or other appropriate containers and stored in an appropriate storage area pending analysis and determination of final treatment and/or disposal requirements.

Cleanup actions are taken by TSD unit operations personnel or other assigned personnel. Actions to be taken might include, but are not limited to, any of the following:

- Neutralization of corrosive spills
- Chemical treatment of reactive materials to reduce hazard
- Overpacking or transfer of contents from leaking containers
- Using sorbents to contain and/or absorb leaking liquids for containerization and disposal
- Decontamination of solid surfaces impacted by released material, e.g., intact containers, equipment, floors, containment systems, etc.
- Disposal of contaminated porous materials that cannot be decontaminated and any contaminated soil
- Containerization and sampling of recovered materials for classification and determination of proper disposal technique
- Followup sampling of decontaminated surfaces to determine adequacy of cleanup techniques as appropriate.

4.18 INCOMPATIBLE WASTE

After an event, the BED or the recovery organization ensures that no waste that might be incompatible with the released material is treated, stored, or disposed of until cleanup is completed. Waste from cleanup activities is analyzed and stored in the same manner as waste received from outside the TSD unit. A field check for compatibility before first storage is performed if necessary. Incompatible waste is not placed in the same container. Containers of waste are placed in storage areas appropriate for their compatibility class.

If it is determined that incompatibility of waste was a factor in the incident, the BED or the recovery organization ensures that the cause is corrected. Examples would be modification of an incompatibility chart or increased scrutiny of waste from a generating unit when incorrectly designated waste caused or contributed to an incident.

4.19 POST-EMERGENCY EQUIPMENT MAINTENANCE AND DECONTAMINATION

All equipment used during an incident is decontaminated (if practicable) or disposed of as spill debris. Decontaminated equipment is checked for proper operation before storage for subsequent use. Consumables and disposed materials are restocked as described in Section 5.0. Fire extinguishers are recharged or replaced.

The BED ensures that all equipment is cleaned and fit for its intended use before operations are resumed. Depleted stocks of neutralizing and absorbing materials are replenished, self-contained breathing apparatus are cleaned and refilled, protective clothing are cleaned or disposed of and restocked, etc.

Notification of state and local authorities is made through the DOE-RL at the completion of cleanup, decontamination, and emergency equipment resupply activities in accordance with Section 10.0. On notification and approval, normal TSD unit operations are resumed. Decontamination of equipment is accomplished at the conclusion of the incident and all equipment is cleaned and or replaced as necessary to its pre-incident conditions. Equipment and personnel decontamination stations are established considering the following information and techniques.

Items to consider when establishing a decontamination station are as follows:

- Water supplies
- Containment/catch basins and/or systems
- Staff necessary to accomplish proper decontamination
- Protective clothing
- Decontamination supplies (buckets, brushes, soap, chemicals as needed)
- Risk to personnel
- Weather conditions; i.e., severe heat, cold (current and forecasted)
- Toxicity of material
- Porosity of equipment to be decontaminated
- Disposal requirements of decontamination rinse
- Use of controlled zones to maintain contamination control.

5.0 EMERGENCY EQUIPMENT

The emergency equipment available for use during an emergency at the Hanford Facility and specific permitted TSD units is discussed in the following sections.

5.1 COMMUNICATION EQUIPMENT

The Hanford Facility has alarm systems that are monitored by the Hanford Fire Department and the Hanford Patrol Operations Center. The alarm signals that exist at the Hanford Facility are identified in Table 3. The TSD unit operations personnel also may use telephones, building PA systems, portable radios, and cellular telephones to summon assistance.

5.2 FIRE CONTROL EQUIPMENT

Many Hanford Facility buildings are equipped with automatic fire-suppression (sprinkler) systems. Portable fire extinguishers are located in working areas in compliance with National Fire Protection Association safety codes. Each Class ABC extinguisher is capable of suppressing fires involving ordinary combustible materials, flammable liquids, oils, paints, flammable gases, and electrical equipment. All extinguishers comply with the National Fire Code standards for portable extinguishers and are inspected monthly. The inspections are recorded on tags attached to each extinguisher.

5.3 PERSONAL PROTECTIVE EQUIPMENT

The TSD units have safety showers and eyewash stations, located as necessary, for personnel protection. Drainage from these stations is contained. In addition to these stations, portable eyewash equipment is maintained at protective storage areas as necessary. These eyewash/shower stations are inspected regularly.

Protective clothing and respiratory protective equipment are maintained for use during both routine and emergency operations. This equipment is identified in the unit-specific contingency plans.

5.4 SPILL CONTROL AND CONTAINMENT SUPPLIES

Supplies of absorbent pillows are located in operating areas as necessary. These pillows absorb organic or inorganic materials and have a rated absorption capacity of approximately 0.26 gallon (1 liter) of waste each. Absorbents might be used for barriers to contain liquid spills as well as for absorbent purposes. Diatomaceous earth for absorption of liquid waste spills is available. Neutralizing absorbent is available for response to acid or caustic spills. A supply of empty containers (U.S. Department of Transportation 17E tight head and U.S. Department of Transportation 17H open head) and salvage containers (overpacks) also are maintained as well as brooms, shovels, and miscellaneous spill response supplies.

Table 3. Hanford Facility Alarm Systems.

Signal	Meaning	Response
Crash Alarm Telephones (steady ringing phone)	Emergency message	Lift receiver, do not speak, listen to caller and relay message(s) to building occupants and BED or alternate.
Gong (2 gongs/second)	Fire	Evacuate building. Move upwind. Keep clear of emergency vehicles.
Siren (steady blast)	Area evacuation	Proceed promptly to accountability area. Follow instructions.
Wavering Siren	Take cover	Close all exterior doors, turn off all intake ventilation and notify manager of whereabouts. Request call back for status and monitor portable radios.
Howler (AA-OO-GAH)	Criticality	Immediately run to the nearest exit and move and remain at least 100 feet (30.5 meters) from the building.

5.5 HANFORD SITE EMERGENCY ORGANIZATIONS

The Hanford Facility has fire and patrol personnel trained and equipped to respond in emergency situations. These personnel are employees of the operations and engineering contractor. The Hanford Fire Department is the Hazardous Material Incident Command Agency for the Hanford Site and has a Hazardous Materials Response Team that is trained to stabilize and control hazardous materials emergencies. A description of equipment for hazardous materials responses available through the Hazardous Materials Response Team is given in Table 4. Locations of the four fire stations on the Hanford Facility are shown on Figure 2.

The Hanford Patrol provides support to the Hanford Fire Department during an incident, including such activities as activation of area crash alarm telephone systems or area sirens (for evacuation or take cover), access control, traffic control, and assistance in emergency notifications.

6.0 COORDINATION AGREEMENTS

This section refers to a number of coordination agreements (memoranda of understanding or MOU) established by and through the DOE-RL to ensure proper response resources availability for incidents involving the Hanford Facility.

An agreement among the four major Hanford Site contractors (an operations and engineering contractor, a research and development contractor, an engineer and constructor contractor, and a medical and health services contractor) defines the interfaces and notifications required during an emergency. The DOE-RL has the overall responsibility for emergency preparedness. Per the agreements, the operations and engineering contractor has responsibility for Site-wide emergency preparedness while each contractor retains responsibility for emergency preparedness at individual units. Agreements have been established with a number of offsite authorities to reduce the impact to human health and the environment in the event that an incident has offsite public health implications, or if an onsite emergency warrants offsite assistance. These agreements are generally activated through the emergency notification of the DOE-RL (Section 4.1).

6.1 LOCAL, STATE, AND FEDERAL AUTHORITIES

Various agreements have been established among the DOE-RL and Benton, Franklin, and Grant Counties and the states of Washington and Oregon. These agreements describe the cooperative arrangements among these agencies for any onsite emergency that warrants offsite assistance. These operations describe the planning for, communication of, and response to emergencies at the Hanford Facility that might have offsite consequences.

Table 4. Fire Department Equipment List. (sheet 1 of 3)

Equipment	Description	*Normally Located
Engines 4 Ladders 4 Pumpers	Examples of equipment contained on engines: • 1,500-2,000 gal/min (5,678.1-7,570.8 L/min) pump • 300-500 gal (1,135.6-1,892.7 L) portable tank • Telescoping nozzle • Jaws of Life.	1 at each station
Tankers 6 Each	Examples of equipment contained on tankers and pumpers: • 500 gal/min (1,892.7 L/min) pump • 1,500 gal (5,678.1 L) tank • 6x6 with 2,000 gal (7,570.8 L) porti-tank • Hose, nozzles, fittings, and tools.	1 at Station 1 2 at Station 2 1 at Station 4 2 at Station 3
Water Tenders 1 Each	Examples of equipment contained on water tenders: • 450 gal/min (1,703.4 L/min) pump • 4,500 gal (17,034.3 L) tank • Hose, nozzles, fittings, and tools.	Station 1
Grass Fire Units 4 Each	Examples of equipment contained on grass fire units: • 100 gal/min (378.5 L/min) pump • 250 gal (946.3 L) tank • 4-wheel drive • Hose, nozzles, fittings, and tools.	1 at each station
Ambulances 5 Each	Examples of equipment contained on ambulances: • Life support systems • Medical supplies and emergency response supplies.	1 at Station 1 2 at Station 2 1 at Station 3 1 at Station 4
Command Vehicles 3 Each	Contains communications equipment and protective equipment for commander.	Station 2

Table 4. Department Equipment List. (sheet 2 of 3)

Equipment	Description	*Normally Located
Attack Vehicles 1 Each	Examples of equipment contained on attack vehicles: • 450 lb (204.1 kg) of purple-K • 300 gal (1,1335.6 L) aqueous film-forming foam concentrate • 300 gal (1,135.6 L) of aqueous film-forming foam pre-mix solution • Hose, nozzles, fittings, and tools.	Station 2
Hazardous Material Vehicle 2 Each	Examples of equipment contained on hazardous material vehicle: • Protective clothing for Hazardous Materials Response Team • Breathing apparatus for Hazardous Materials Response Team • Diking, plugging, and damming equipment • Detection instruments for Hazardous Materials Response Team • Tools for plugging and repairing leaking containers • Overpack containers for leaking containers • Command module with material safety data sheets, software, and portable meteorological station • Tools and communications devices necessary to provide communications during emergency response activities.	1 at Station 2 1 at Station 3
Metal Fire Response Vehicle 1 Each	Examples of equipment contained on metal fire response vehicle: • Equipment for response to special metals fire • 500 lb (226.8 kg) of extinguishing powder • 1,000 lb (453.6 kg) of carbon microspheroids.	Station 4

Table 4. Department Equipment List. (sheet 3 of 3)

Equipment	Description	*Normally Located
Mobile Air Vehicle 1 Each	Examples of equipment contained on mobile air vehicle: • Mobile air compressor, recharges self-contained breathing apparatus cylinders • Tools and fittings for operation of vehicle and spare cylinders.	Station 4

*The Hanford Fire Department Chief has the authority to direct the placement of Fire Department equipment as needed to control emergency events. The Hanford Fire Department Chief also has the authority to take pro-active action and assign different vehicle locations based on such conditions as fuel moisture content, area fire history, work in progress, or other conditions that could arise.

gal = gallon(s)
gal/min = gallon(s) per minute
kg = kilogram(s)
L = liter(s)
L/min = liter(s) per minute
lb = pound(s)

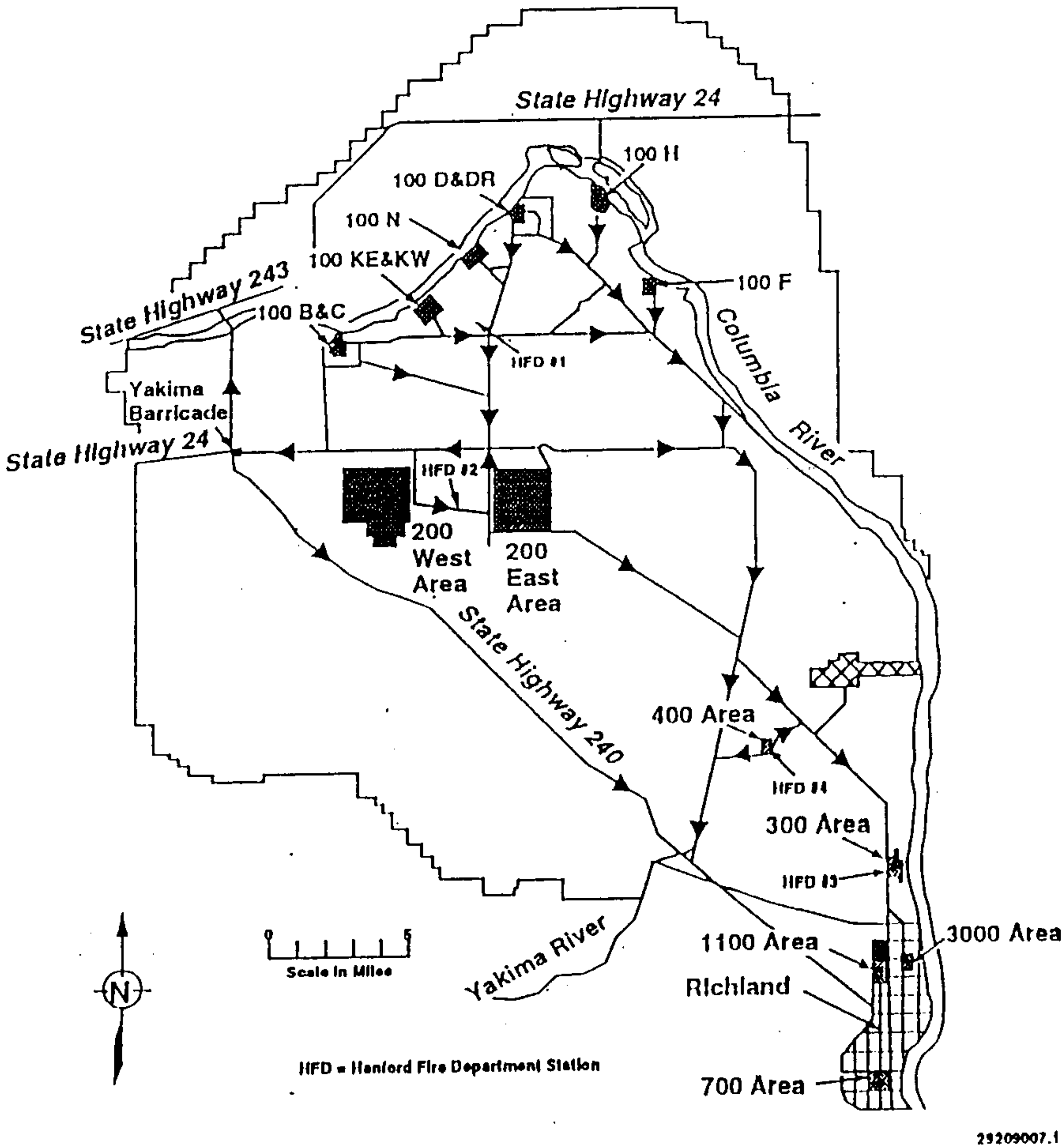

Figure 2. Locations of the Fire Stations on the Hanford Facility.

6.2 HANFORD FIRE DEPARTMENT MUTUAL AID

The Hanford Fire Department provides fire department services for the Hanford Site and Hanford Facility. Mutual aid agreements have been established with Richland, Kennewick, and Pasco fire departments; with Benton County Fire Districts 1 through 6, Franklin County Fire District 3, and Walla Walla Fire District 5.

6.3 MEDICAL AND FIRST AID

Professional medical help is provided onsite by the DOE-RL through the Hanford Environmental Health Foundation. Doctors and nurses are available for emergency assistance at all times. These medical personnel are trained in procedures to assist personnel contaminated with hazardous and/or radioactive material. Emergency call lists are maintained to provide professional medical consultation at all times.

Referral to offsite hospital facilities is made by the Hanford Environmental Health Foundation physician providing emergency assistance by telephone or in person. The primary hospital used in emergencies is Kadlec Hospital, Richland. Kennewick General Hospital, Kennewick, and Our Lady of Lourdes Hospital, Pasco, are used as backup facilities. Agreements have been established among these hospitals and the DOE-RL.

6.4 AMBULANCE SERVICE

Ambulance service is provided by the Hanford Fire Department, which uses paramedics and emergency medical technicians as attendants. This service is available from area fire stations on a 24-hour, 7-day basis. Additional ambulance service is available from other local city fire departments through the mutual aid agreements (Section 6.2).

6.5 UNIFIED DOSE ASSESSMENT CENTER

The Unified Dose Assessment Center (UDAC) is the technical extension of the DOE-RL-EACT, providing services to both the DOE-RL-EACT and the ECC. The primary mission of the UDAC is to provide recommendations for protective actions, dose calculations and projections, and consultation in the area of industrial hygiene for hazardous materials, biology, environmental monitoring, and meteorology to support the DOE-RL-EACT and the ECC.

Industrial hygiene and biological consultants at the UDAC advise and assist in determining proper response procedures for spills or releases of toxic, flammable, carcinogenic, and pathogenic materials. The UDAC personnel are responsible to provide a central unified assessment of the dispersion and impact of environmental releases from the Hanford Facility. In communication with the ECC, UDAC coordinates the assessment of impacts and assists in the determination of actual and potential release scenarios.

6.6 HANFORD PATROL MUTUAL AID

The Hanford Patrol serves as the security and law enforcement agency for the Hanford Facility. In the event of an emergency, the Hanford Patrol provides services such as activating the crash alarm systems or area sirens, coordinating the movement of emergency responders through security gates, assisting evacuation, establishing barricades, and making necessary notifications through the single point-of-contacts. Agreements also have been established with the Richland, Kennewick, and Pasco police departments and the Benton County Sheriff's Office to provide additional backup capabilities if required.

6.7 RIVER ALERTING

An agreement exists among the DOE-RL, the Washington Public Power Supply System, Benton and Franklin Counties, and the Thirteenth Coast Guard District to ensure safety on the Columbia River during an emergency at the Hanford Facility and to coordinate response activities for alerting personnel on the Columbia River.

6.8 METEOROLOGICAL INFORMATION

An agreement is in place between the DOE-RL and the National Weather Service to define mutual responsibilities for providing meteorological information in an emergency situation. Additional meteorological information can be obtained from the Hanford Site weather station.

6.9 WASHINGTON PUBLIC POWER SUPPLY SYSTEM

An agreement has been established between the DOE-RL and Washington Public Power Supply System for providing mutual assistance as needed and available in the use of facilities and equipment for personnel decontamination, first aid, evacuation and reassembly areas, respiratory protective equipment, protective clothing, radiological survey equipment, resources for river evacuation, and radiological assistance response.

7.0 EVACUATION PLAN

Each TSD unit has a building emergency procedure that includes an evacuation plan that includes emergency signal identification and staging area location. In the event a Facility-wide evacuation is required, TSD unit personnel evacuate to their designated staging area, are accounted for, and receive directions on routes to take to safely evacuate the area. If the primary route is blocked by the emergency, personnel use alternate evacuation routes determined at the time of the event.

8.0 TERMINATION OF EVENT

It is a function of the BED (Emergency Coordinator) to declare the termination of an event. However, in the event additional emergency centers are activated only the highest activated level of the emergency organization, in conjunction with the BED, will declare that an event has ended. If the DOE-RL-EACT is activated, only the DOE-RL director officially terminates the event. In all cases, however, the BED or Emergency Coordinator must be consulted before reentry is initiated.

9.0 ACCIDENT AND/OR EVENT RECOVERY

Restart of operations after an emergency is conducted as described in the following paragraph. A recovery plan is developed when necessary. A recovery plan is needed following an event when further risk could be introduced to personnel, a TSD unit, or the environment through recovery action and/or to maximize the preservation of evidence. If a recovery plan is required, it is reviewed by appropriate personnel and approved before restart. Restart of operations is performed in accordance with the approved plan.

For emergencies not involving activation of the ECC, the BED ensures that conditions are restored to normal before operations are resumed. If the ECC was activated and the emergency phase is complete, a special recovery organization could be appointed at the discretion of the BED to restore conditions to normal. The makeup of this organization depends on the extent of the damage and its effects. The recovery organization will be appointed by the appropriate contractors' emergency director.

The recovery phase of the accident is not handled under emergency criteria, but rather according to a recovery plan developed for the specific event. Thus, the TSD unit manager will create a recovery organization encompassing all required aspects of engineering, operations, maintenance, and functional support, with direction provided by the appropriate contractor organizations (i.e., hazardous waste unit or the industrial hygiene and safety department). This includes making proper notifications to official agencies [i.e., DOE, U.S. Environmental Protection Agency (EPA), and Ecology]. Recapture (where possible), store, and dispose of any hazardous material that is released, and any resultant soil, surface water, or other material contaminated by a spill, toxic fume generation, fire, or explosion.

No waste that might be incompatible with the released material is treated, stored, or disposed of until cleanup is completed.

All emergency equipment is cleaned and fit for its intended use following an emergency (Section 4.8).

10.0 REQUIRED REPORTS

Three types of written post-incident reports are required for incidents at the Hanford Facility. These reports are summarized in the following sections.

10.1 REPORT TO ECOLOGY AND U.S. ENVIRONMENTAL PROTECTION AGENCY

Required written reports are submitted to the DOE-RL to be forwarded to Ecology and the EPA concerning the incident. The report must include the following:

- Name, address, and telephone number of DOE-RL contact
- Name, address, and telephone number of the affected TSD unit
- Date, time, and type of incident (e.g., fire, explosion)
- Name and quantity of material(s) involved
- The extent of any injuries if any
- Assessment of any actual or potential hazards to human health or the environment caused by the incident
- Estimated quantity and disposition of recovered material that resulted from the incident
- Cause of the incident
- Description of corrective action taken to prevent reoccurrence of the incident.

10.2 OCCURRENCE REPORTING

Under DOE Order 5000.3A, an occurrence report is required for incidents occurring at the Hanford Facility involving hazardous materials release, fire, etc. Specific details of this reporting system are found in the DOE Order. To summarize, the event is categorized within 2 hours and proper notifications are completed to onsite and offsite agencies to include contractor, DOE, county, and state organizations.

Occurrences are investigated, reported, and analyzed promptly to ensure that effective corrective actions are taken in compliance with contractual and statutory requirements. All incidents are recorded in the building manager's log book, and the log book is audited to ensure that incidents were reported and handled properly. In the DOE reporting system, three levels of incidents are described, in descending order of severity: emergency, unusual occurrence, and offnormal occurrences.

10.2.1 Emergency Incident Reporting

An emergency incident is an incident in progress or having occurred that is the most serious occurrence and requires an increased alert status for onsite and, in specified cases, for offsite authorities. There are three classifications associated with emergency events: Alert, Site Area Emergency, and General Emergency. Occurrences are classified into one of the three levels based on real or potential consequences to personnel, facilities, or the environment, both on and off of the Hanford Facility. Current MOUs between the state of Washington and the Hanford Site identify events that would be classified at the stated levels. Emergency events require notification within 15 minutes of classification to affected populations, with followup notifications every 15 minutes.

10.2.2 Unusual Occurrence Reporting

An unusual occurrence is a nonemergency occurrence that has significant impact or potential for impact on safety, environment, health, security, or operations. Generally, these types of events result in release of radioactive or hazardous materials in minor amounts, involve degradation of unit safety systems, result in fatalities, exposures to hazardous or radioactive materials, or significant contamination incidents.

10.2.3 Offnormal Event Reporting

An offnormal event is a significant deviation from normal operation that requires categorization and reporting. Hanford Facility management is required to evaluate an event to determine the depth of investigation and level of reporting required.

11.0 CONTINGENCY PLAN LOCATION

Copies of this Plan are maintained at the following locations:

- Each specific TSD unit
- Hanford Fire Department (area fire stations)
- Area ECCs
- Occurrence Notification Center
- The DOE-RL Emergency Control Center, Federal Building, Richland.

12.0 REFERENCES

DOE Order 5000.3A, *Occurrence Reporting and Processing of Operations Information*, U.S. Department of Energy, Washington, D.C.

DOE Order 5500.1B, *Emergency Management Systems*, U.S. Department of Energy, Washington, D.C.

NIOSH, 1985, *Pocket Guide to Chemical Hazards*, National Institute of Occupational Safety and Health, U.S. Department of Health and Human Resources, Public Health Service, Centers for Disease Control, Washington, D.C.

WAC 173-303, *Dangerous Waste Regulations*, Washington State Department of Ecology, Olympia, Washington.

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APPENDIX 6B

EMERGENCY PLAN FOR 1706KE BUILDINGS

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This plan covers the following Facilities: 1706KE, 1706KEL, 1706KER.

Approved: B B Emor... for 4/7/92
Building Emergency Director — Date

JR Boetes 4/6/92
Emergency Preparedness Representative — Date

OHS: 4/23/92
Nuclear Facility Safety Representative — Date

KA Gano 4/13/92
Environmental Protection Representative — Date

This document will be reviewed and updated at least annually by the Building Emergency Director and approved by the Manager, Emergency Preparedness or his delegate.

9 1 1 2 1 7 0

1.0 INTRODUCTION

The 1706KE Emergency Plan has been designed to provide a system of planned responses which will minimize risks to personnel, equipment, buildings, and the environment in the event of an emergency situation. This Plan is applicable to the total facility, employees and visitors, identified in Section 1.1.

Emergency situations considered for this facility and identified as requiring emergency response plans are identified in section 3.0 Potential Emergency Conditions. The six categories of emergencies considered are identified as follows:

- Operational Emergencies, to Include Security Events
- Natural Hazards
- Non-Radioactive Hazardous Material Hazards
- Radioactive Material
- Criticality
- Explosive Materials/Munitions

Planned responses are those activities which are intended to provide direction to control a fire, minimize the immediate effects of an explosion, contain a spill or release, and minimize the effects of a criticality incident. These responses include, for example: notification of personnel, emergency organizations, and the building emergency director. The Plan also provides guidance for notifying personnel to take cover, evacuate, or take other actions, which are determined by the particular circumstances. The planned responses also provide for formal notification and reporting, investigation of the incident, cleanup, and restoration.

The 100K Area is located on the 570 sq mi, U. S. Department of Energy (DOE) Hanford Site in southeastern Washington State. The 1706KE building is located in the western portion of the 100 Area in the Hanford Reach near the northern portion of the Hanford Site.

A discussion of the 1706KE Facility is contained in Section 1.4.

1.1 FACILITY NAME: **U.S. Department of Energy Hanford Site 1706KE**

1.2 FACILITIES LOCATION: **Benton County, Washington Within the 100K Area**

Facilities covered by this plan are: 1706KE, 1706KEL,1706KER

1.3 OWNER/OPERATOR: U. S. Department of Energy
Field Office, Richland
P.O. Box 550
Richland, Washington 99352

CO-OPERATOR: Westinghouse Hanford Company
P. O. Box 1970
Richland, Washington 99352

1.4 DESCRIPTION OF THE FACILITY AND OPERATIONS:

1706-KE Facilities (1706-KE, 1706-KEL, 1706-KER)
Engineering and Environmental Demonstration Laboratory

1706-KE Office Space, and Laboratories
1706-KEL Waste Water Pilot Plant, and RCRA Decon Facility
1706-KER Storage, and Laboratory

The 1706-KE and 1706-KER buildings were constructed in 1954 as part of the 100-K production reactor site. The original mission of the laboratory was coolant and corrosion studies, irradiation testing, and reactor fuel development. For these purposes the facility provided cooling water to eight single pass process tubes and four recirculating process tubes in the 100-KE reactor core. In addition 22 out-of-reactor test loops, designed to simulate various operating parameters, were located within the 1706-KE complex. All the in-core test facilities were deactivated when the 100-KE reactor shut down in 1971. All but four of the test loops (TF-4, TF-7, TF-9, and TF-15) have since been removed from the facility.

The main floor of the 1706-KE building (0-ft level) contains office space, store rooms, lunch room, locker room and laboratories. Also located on this level is a demineralizer plant which supplies make-up water to the 105-KE and 105-KW fuel storage basins.

The basement of the 1706-KE building (-13-ft level) is mostly open work area containing two test loops, and several water treatment test units. The KER control room which contains most of the switch gear for the facility is located on this level. A stairway leads from the -13-ft level to the -27-ft pump room.

The sub-basement of the 1706-KE building (-27-ft level pump room) contains the low and high pressure pumps which supplied eight single pass process tubes in the 100-K reactor core. Also located at this level are four clearwells, each with approximately 18,000 gallons capacity. Clearwells no. 1 and no. 2 were used, until recently, for the temporary storage and neutralization of regeneration waste from the demineralizer plant. Clearwell no. 3 is not utilized and clearwell no. 4 is used to store demineralized water. The only active systems on this level are the building's air compressors and the recirculation pumps for the demineralized water system.

1.4 DESCRIPTION OF THE FACILITIES AND OPERATIONS: (continued)

The 1706-KER 0-ft level is not occupied, a portion of the facility is used for equipment storage. The only active systems within the facility are electrical switch gear.

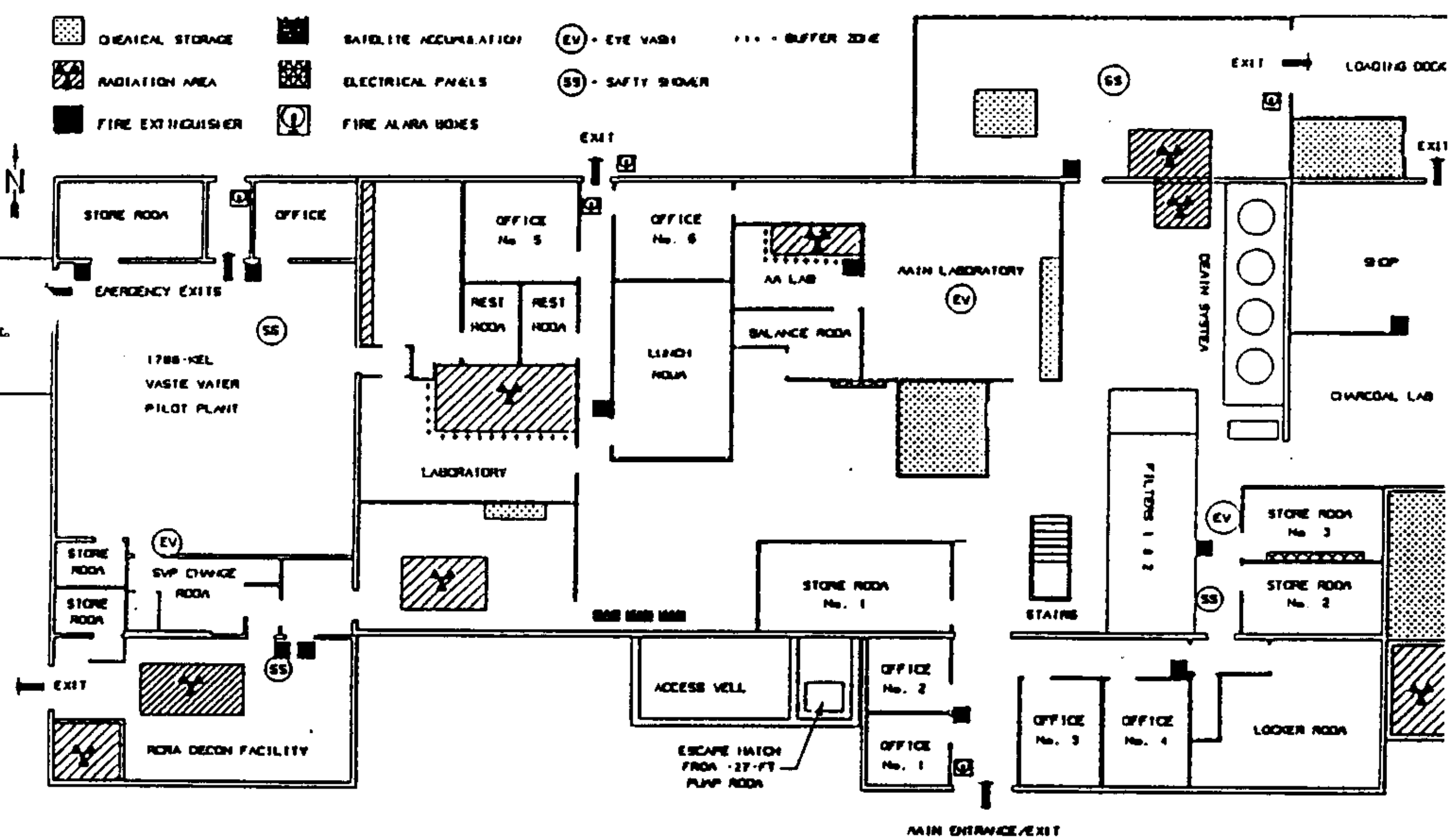
The 1706-KER -27-ft level is accessed via a stairway leading from the -13-ft level of 1706-KE. Located on this level are a SWP change room and a laboratory utilized for radiological work. This level of the facility also includes four cells which contained the pumps and heat exchangers associated with the recirculating process tubes in the 100-K reactor core. These cells, the north corridor and the 105-KE pipe tunnel are considered a deactivated area.

The 1706-KEL building was added to the 1706-KE complex in 1961 to provide additional laboratory space. The portion of the building that was formerly the "hot" laboratory has been modified to accommodate the RCRA sample component cleaning and decontamination station. The portion of the building that was formerly the "cold" laboratory is currently being renovated in preparation for the Waste Water Pilot Plant.

1.5 DESCRIPTION OF THE FACILITY AND GENERAL LOCATION:

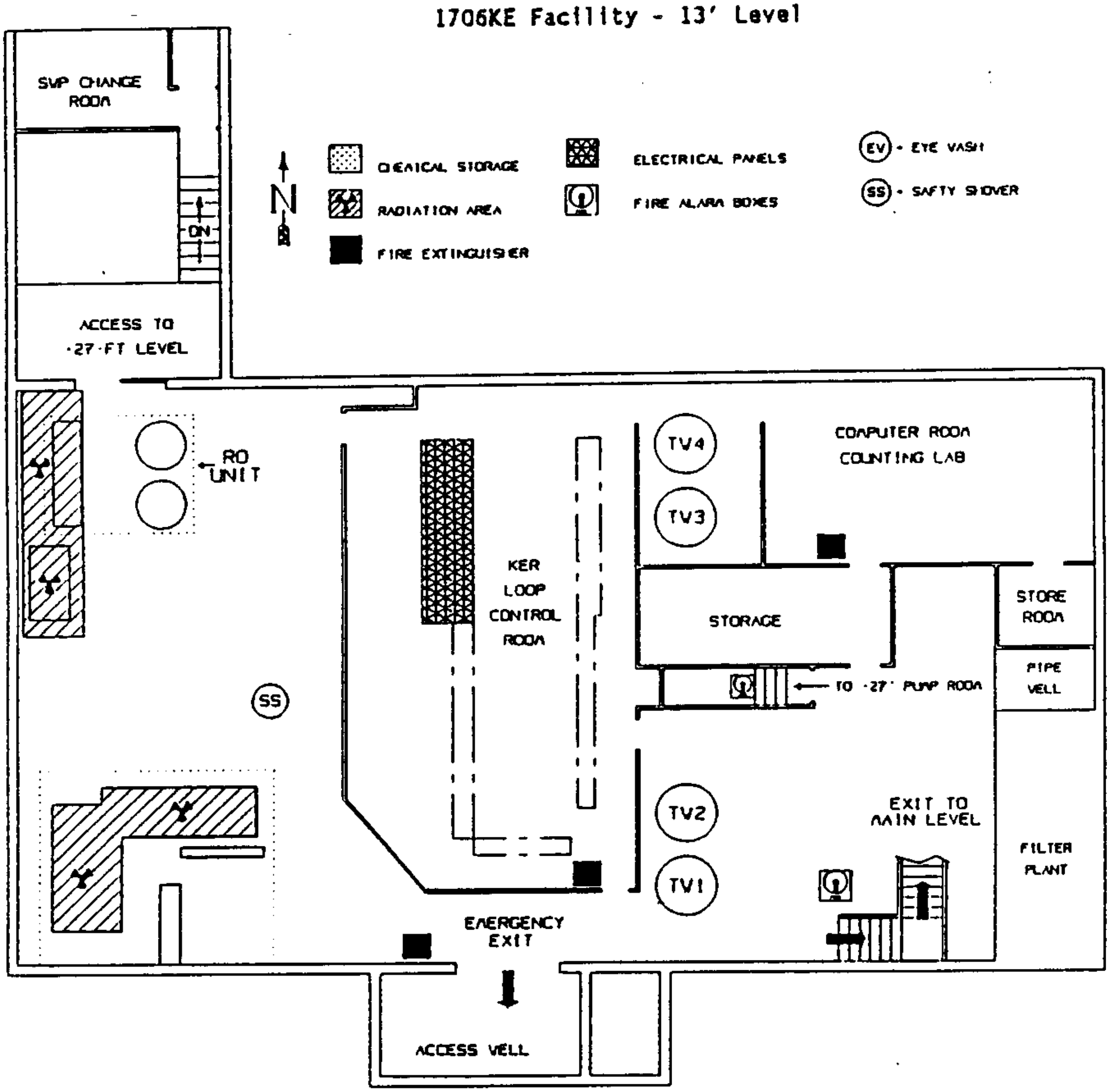
1.5.1 Building Evacuation Routes (Building Layout, and Exits (E))

1706KE Facility - 0' Level



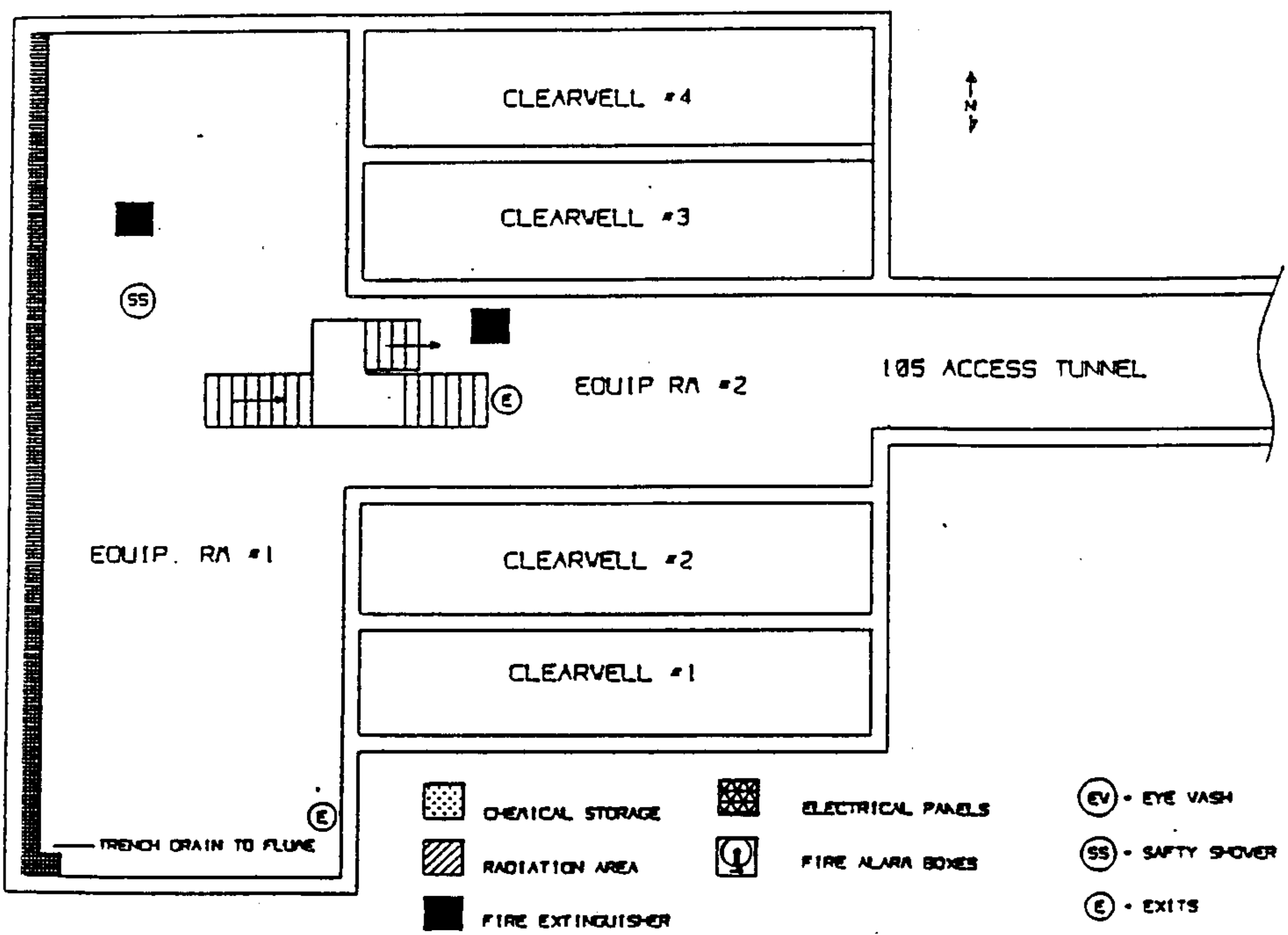
1.5.1 Building Evacuation Routes (Building Layout, and Exits (E)) (continued)

1706KE Facility - 13' Level



1.5.1 Building Evacuation Routes (Building Layout, and Exits (E)) (continued)

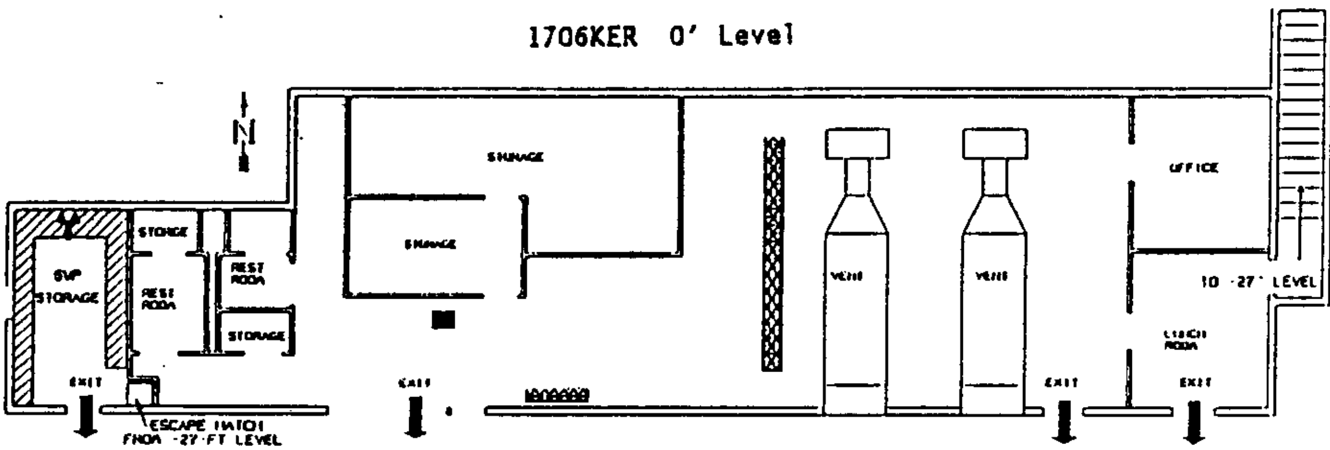
1706KE Facility -27 Level Pump Room



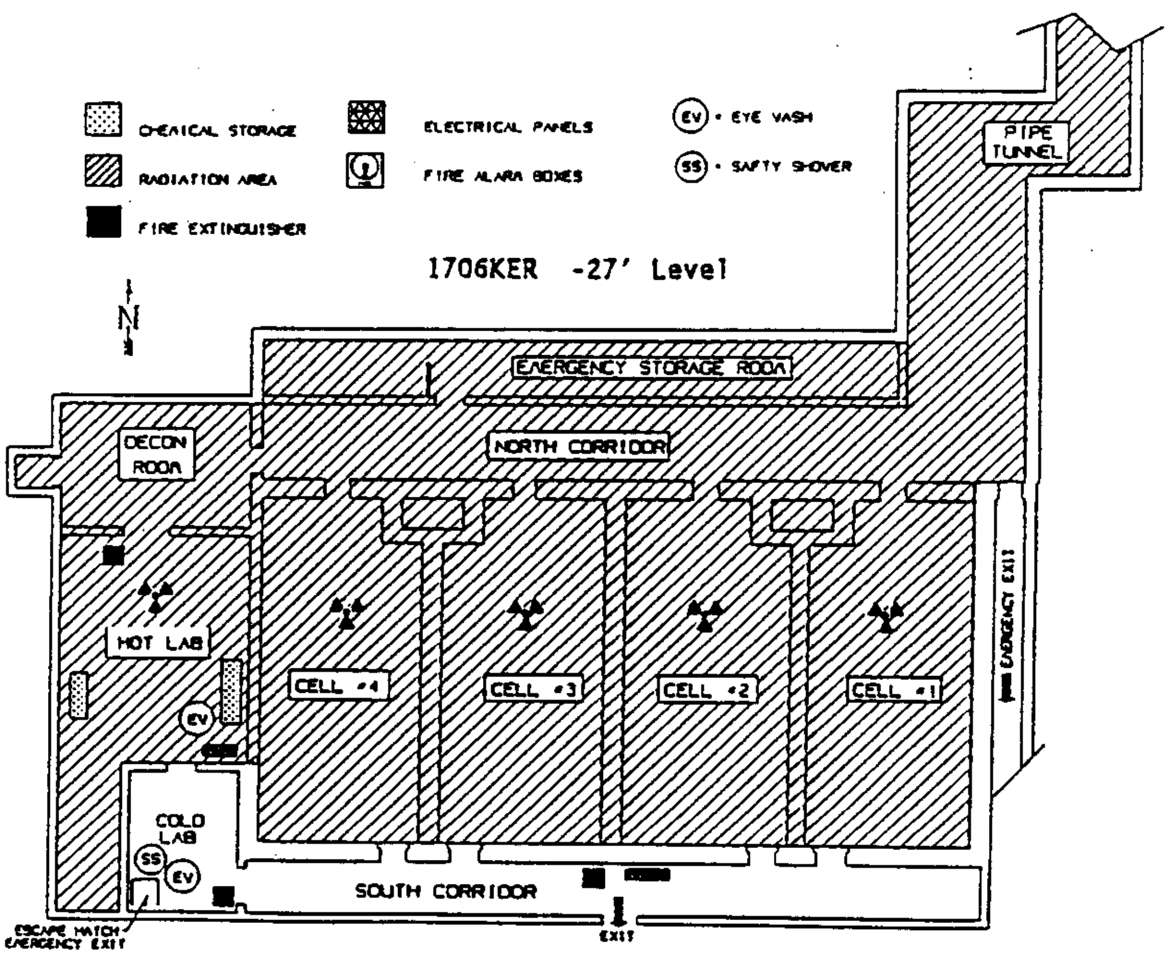
9 1 1 2 1 7 6

1.5.1 Building Evacuation Routes (Building Layout, and Exits (E) (continued)

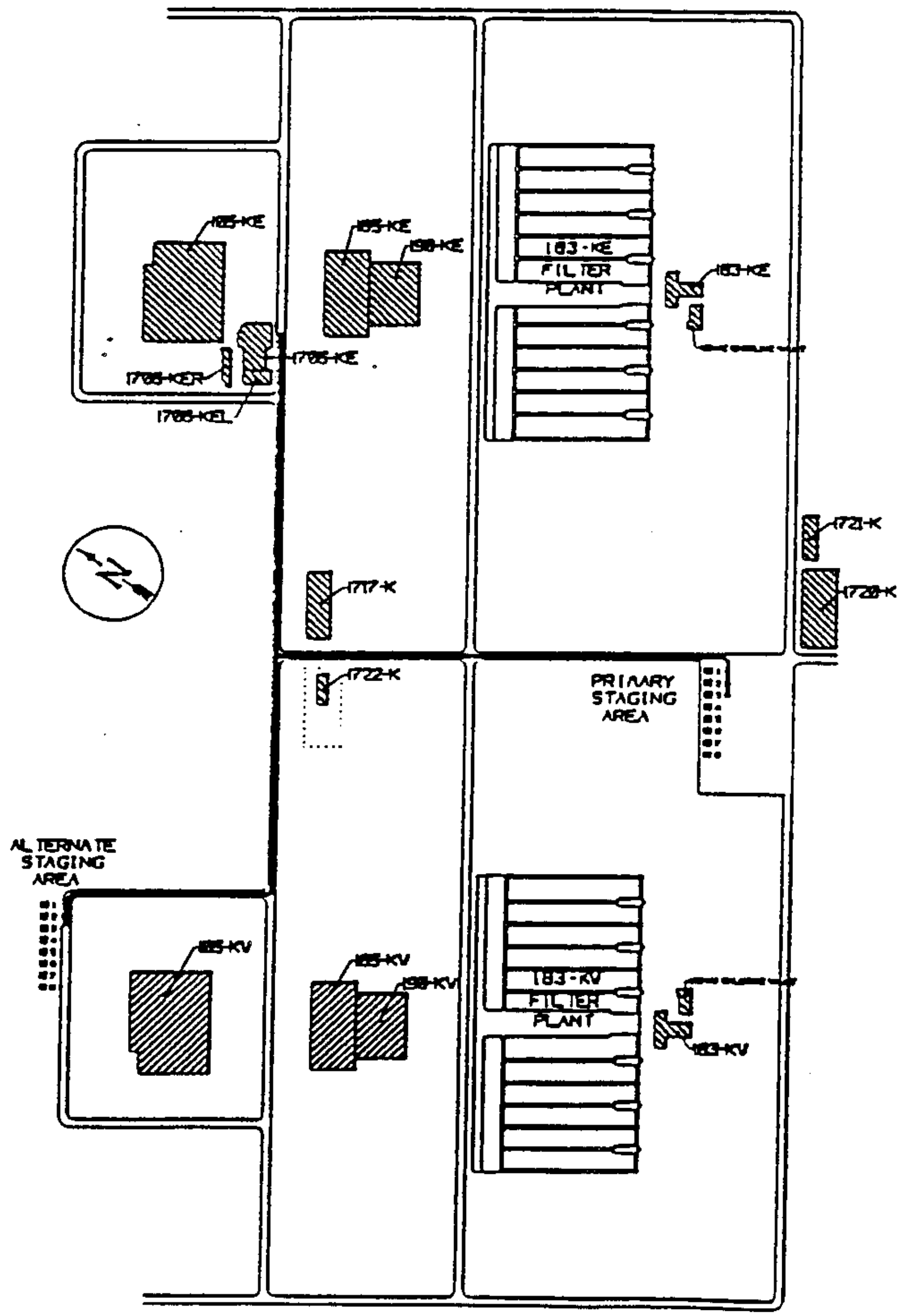
1706KER 0' Level



1706KER -27' Level



1.5.2 Building Evacuation Routes (Building to Staging Area)



2.0 PURPOSE

2.1 PURPOSE OF PLAN

The purpose of the 1706KE Building Emergency Plan is to provide employees, and visitors, information necessary to react to emergency situations in order to:

- Maximize employee safety, minimize the risk to life, and provide prompt and efficient treatment for injured persons.
- Ensure continuity of leadership at all times and in all emergency situations.
- Minimize the effects of an accident on the health and safety of the general public and the environment.
- Minimize property damage.
- Ensure prompt internal and external communications with responsible authority.

2.2 EMPLOYEE REQUIREMENTS

Each employee assigned to this facility is required to annually review this plan and document that review using the "Facility Emergency And Hazard Information Checklist" (form number A-6000-784) as defined in WHC-CM-4-1, Emergency Plan.

3.0 POTENTIAL EMERGENCY CONDITIONS

This section provides a generalized idea of the types and amounts of hazardous materials stored and used in the 1706KE Building.

Job Safety Analysis, Radiation Work Procedures, and/or Material Safety Data Sheets provide the basis for safe use of the materials in the workplace. Each employee shall know the appropriate actions to take in case of a spill or unwanted release (where specified).

3.0.1 Assessment

After identifying the source and nature of the incident, the building emergency director must assess any hazards to human health or the environment. Knowledge of these factors is vital to a practical assessment of such hazards.

- Origin of the leak, fire, or explosion (if known).
- Conditions of the source (e.g., controllable/uncontrollable leak or fire, easily moved, immovable).
- Materials involved
- Physical state of materials present (e.g., solid, liquid, or gas).
- Evidence of reaction(s) (e.g., fumes, flames, evolved gases).
- Odor and color of materials.

3.0.2 Assessment Objectives

The assessment factors gathered at the scene, in conjunction with the detailed information available about materials involved, provides enough data to assess the probability of further hazards resulting from the emergency and determine the appropriate response actions necessary.

Any emergency assessment should consider the potential for each of the following (as appropriate to the emergency conditions present).

- Spread of fire
- Explosion or further chemical reaction
- Increase in spill volume
- Generation of new compounds and their hazards
- Generation or spread of toxic, irritating, or asphyxiating gases
- Identification of exposure and/or release pathways
- Effect of exposure and appropriate safety precautions
- Contaminated run-off from spilled chemicals, response chemicals and/or fire, explosion, or reaction residues
- Impacts beyond the immediate area involved

NOTE: In cases involving soil contamination, assessment requires that sampling be performed to determine the lateral and vertical extent of contamination. The building emergency director is responsible for coordinating onsite characterization activities which will be performed by Hanford Site organizations.

3.1 EVACUATION AND TAKE COVER

Evacuation alarms at this facility may be activated for the following reasons:

- Release of hazardous material (radioactive or non-radioactive) at this or another facility impacting this facility
- Loss of utilities
- Protective response to emergencies affecting ability to inhabit the facility

Take Cover alarms at this facility may be activated for the following reasons:

- Release of hazardous material outside of a facility
- Attack by hostile factions
- Protective response to emergencies affecting the facility or personnel

3.2 OPERATIONAL EMERGENCIES

The following emergency situations are those considered credible for this facility, unless determined to be N/A (Not Applicable). Described are the types and extent of credible emergency events. The response plan for each type are listed in Section 6.0 of this plan.

The following sections contain a description of the "Worst Case" accident anticipated for each of the identified credible emergencies. This information is typically derived from the facility Safety Analysis Report, hazards evaluation, or risk assessment for the facility.

3.2.1 Bomb Threat

A Bomb Threat is a credible event. Actions necessary to respond to a bomb threat are covered in Section 6.0. 1706KE was not designed to withstand a bomb blast.

3.2.2 Industrial Accidents

A series of incidents with a potential for nuclear criticality accidents are not applicable to 1706KE. Noncriticality, industrial, related accidents include inadvertent chemical release, pressure release (Section 3.2.10), and broken water supply mains.

A criticality is not possible at this facility. Industrial accidents could potentially affect this facility.

3.2.3 Loss of Electricity

The hazards associated with the loss electricity the exhaust ventilation systems and the compressed air systems will shut down. The shut down of the exhaust ventilation systems would leave contaminated hoods unventilated. Resulting in a potential release of airborne radioactivity. The shut down of the compressed air systems would create a loss of control of the demineralize systems. Resulting in large amounts of water dumping to the clearwells.

The portal monitor detectors would not function. Thus, personal surveys would be required at the 1706KE staging area.

3.2.4 Loss of Water - N/A

3.2.5 Loss of Ventilation

The hazards associated with a loss of ventilation are potential airborne contamination and contamination spread.

3.2.6 Loss of Steam - N/A

3.2.7 Loss of Air

Loss of air would shutdown the facility and require the evacuation of the building. Loss of air would impact the demineralizer system.

3.2.8 Fire and Explosion

In an event of a fore and or explosion there is a potential for hazardous chemical and radioactive releases. Such upsets should be contained within the facilities boundaries.

3.2.9 Major Tests Upset

There is a potential for chemical and/or low level radioactive releases. There may be electrical hazards.

3.2.10 Pressure Hazards

The following pieces of equipment are considered to be a pressure hazard:

- TF-9 Test Loop, located on the 0 foot level of 1706-KE
- Demineralize, located on the 0 foot level of 1706-KE
- Reverse Osmosis System, located in the Waste Water Pilot Plant, 1706-KEL
- Ultraviolet Oxidation System, located in the Waste Water Pilot Plant, 1706-KEL
- Air Receiving Pressure Vessel, located in the access well.

In an event of pressure equipment failure one of the following or combination of the following could occur:

- Radioactive releases
- Large amounts of water discharge
- Hazardous Chemical Releases
- Loss of compressed air.

If an upset occurs as such it should be contained within the facilities boundaries.

3.2.11 Security Event - N/A

3.3 NATURAL HAZARDS EMERGENCIES

The following emergencies are those applicable to facilities on the Hanford Site. Response plans for each are contained in section 6.0.

3.3.1 Seismic Event

The Design Basis Earthquake (DBE) for 1706KE is defined as an event producing a maximum horizontal ground acceleration of 0.25 g simultaneously with a maximum vertical ground acceleration of 0.17 g at zero period.

3.3.2 Volcanic Eruption/Ashfall

Hazards associated with a volcanic eruption/ashfall include potential interference with building ventilation and electrical systems.

3.3.3 High Winds/Tornado

The site is subject to frequent strong winds. The probability of a tornado in any year at any point within the 100 mile radius of the Hanford Meteorology Station is 6.8 X 10^{-6}/year.

3.3.4 Flood

The Probable Maximum Flood (PMF), as defined by the Corps of Engineers, will reach 423 feet MSL. Realistic modes of upstream dam failures or damage would produce a flood not exceeding the PMF. Therefore, a flood emergency is not applicable to 1706KE as the maximum PMF is 8 feet below the building elevation.

3.3.5 Range Fire

Not Applicable. K Area is surrounded by a gravel barrier and no sage is contained within.

3.4 HAZARDOUS MATERIALS AND MIXED WASTE SPILLS/RELEASES

This section addresses the spill and or release of non-radioactive hazardous materials, as well as mixed waste (radioactively contaminated hazardous materials). The term hazardous material as used here means both non-radioactive and mixed waste.

Hazardous Materials used and stored throughout the 1706-KE facilities fall under the following categories:

- Corrosives, any liquid or solid that causes visible destruction or irreversible alterations in human skin tissue at the site of contact, or in the case of leakage from its packaging, a liquid that exceeds a corrosion rate on steel of .250 inch per year. Such as: Sulfuric Acid, Sodium Hydroxide.

- Flammable, any liquid having a flashpoint below 100oF(37.8oC), except any mixtures having components with flashpoints of 100oF(37.8oC) or higher, the total of which makes up 99% or more of the total volume of the mixture. Such as: Hexone, 2-propanol.

- Flammable Gases, either a mixture of 13% or less (by volume) with air that forms a flammable mixture or the flammable range with air is wider than 12% regardless of the lower limit. Such as: Hydrogen

3.4 HAZARDOUS MATERIALS AND MIXED WASTE SPILLS/RELEASES (continued)

- Combustibles, any liquid having a flashpoint above 100oF(37.8oC) and below 200oF(93.3oC), except any mixtures having components with flashpoints of 200oF or higher, the total of which makes up 99% or more of the total volume of the mixture. Such as: Tridecane, Benzaldehyde.

- Oxidizers, a substance that yields oxygen readily to stimulate the combustion of organic matter. Such as: Hydrogen Peroxide, Ozone, Potassium Permanganate.

- Carcinogens, toxic substances that can be harmful to humans by contact, inhalation, and ingestion. Such as: Chloroform, 2-butoxyethanol, Benzaldehyde.

The primary areas where hazardous chemicals are being used are: 1706-KE Main Laboratory and the 1706-KEL Waste Water Pilot Plant. The following are the main storage areas for:

- Pressurized gases: Gas cylinder shed located on the loading dock on the north side of the building.

- General reagents: Non-corrosive, Non-flammable are located in the chemical storage cabinets on east wall of main laboratory.

- Flammable reagents: Flammable storage cabinets in main bay adjacent to chemical store room.

- Acids and Bases: Acid are located inside an acid cabinet, bases stored on shelves within the chemical store room.

- Bulk chemicals: Greater than five gallons are located on shelves or in catch pan in chemical store room.

- Janitorial products: Store room no. 3.

- Shop chemicals (solvents, lubricating oils, etc.): Shop.

The use, storage, and control of hazardous material is controlled by Plant Operation Procedures and Material Safety Data Sheets which are located in the central files in the 1706-KE lobby. It is not feasible to list all of the chemicals that are being used and stored, because of the large variety and minute amounts. For updated chemical inventory and the specific hazards associated with those chemicals contact the Engineering Environmental Demonstration Laboratory personnel.

The following sections are examples of conditions that might result from a spill or release of Hazardous Materials.

3.4.1 Spill of Hazardous Material

In the event of a spill the hazards to humans associated with the chemicals may fall under the following categories:

- Injury due to contact of skin or eyes with hazardous materials.
- Injury due to exposure (inhalation) to fumes from hazardous materials.
- Fire or explosion (assuming material is flammable or explosive).
- Violent reaction and injury resulting from improper use or accident involving incompatible materials.
- Long term health effects from chronic exposure to hazardous/ carcinogenic materials.

3.4.2 Fires or Explosions Involving Hazardous Material

Glycerine and potassium permanganate which are stored in this facility can react explosively if mixed. Flammable gases (acetylene, oxygen) are stored in cylinders and could produce a fire/explosion hazard.

3.4.3 Toxic Fumes Hazards

A spill of one pound of carbon tetrachloride (a human carcinogen) would be a toxic vapor hazard to employees in the immediate area but would not be a hazard in adjacent work areas. A spill of a few pounds of organic solvents stored in this building would be an irritant level of vapors but not a toxic hazard. A spill of aqueous solutions of acids, base or salts stored at this facility would not be a fume or vapor hazard.

3.4.4 Reactive Chemical/Corrosive Material Hazards

Rupture of a tank containing large quantities of sulfuric acid or sodium hydroxide could result in a widespread contact area for hazardous corrosive material. Acids and caustic are also stored inside the facility in jug size containers. Spill of a jug could result in a single exposure to contact with a corrosive material.

3.4.5 Thermal Reactions/Hazards - N/A

3.4.6 Flammable Material/Liquids Hazards

Drums and small containers of flammable liquids (Stoddard Solvent, acetone, methyl ethyl ketone) are stored which could result in the rapid spread of fire within the facility.

3.4.7 Asbestos Release

Much of the walls and piping throughout 1706KE has asbestos insulation. The hazard associated with asbestos is that it is a carcinogen. If asbestos insulation is inadvertently exposed, contact the building manager so that the appropriate measures can be taken.

3.5 RADIOACTIVE MATERIALS

Radioactive materials <u>ARE</u> used and stored in 1706KE. The following types of emergencies are those identified as credible for this facility. Described are the credible types and extent of emergency situations, unless identified as N/A (Not Applicable). The response plan for each type of emergency is listed in Section 6.0 of this plan.

3.5.1 Gaseous Effluent Discharges (Stack Releases)

The 1706KE Facility has 4 hood ventilation stacks that have HEPA filters. A credible accident situation could happen through the HEPA hood ventilation system.

3.5.2 Liquid Effluent Discharges

The test loops have trace amounts of contamination. In case of failure there is a potential release of radioactive liquids. The radioactive liquids are controlled at the floor drains which are plugged. Therefore radioactive release would be contained within the facility.

3.5.3 Significant Contamination Spread/Releases

A policy of exposure control is applied at 1706KE to maintain radiation exposure to personnel, from all sources, as low as reasonably achievable (ALARA).

3.6 CRITICALITY - N/A

3.7 EXPLOSIVE MATERIALS/MUNITIONS HAZARDS - N/A

3.8 SPECIFIC HAZARDS ASSOCIATED WITH ACTIVITIES AT 1706KE

3.8.1 Demineralizer

A demineralize plant located on the 0-ft level of 1706-KE is used to provide demineralized water for the 105-KE and 105-KW fuel storage basins as well as for use within the laboratory. During normal operation, the plant is capable of providing approximately 130 gpm of water at 120 psi.

3.8.1 Demineralizer (continued)

When the ion columns on the demineralize plant become depleted a regeneration is performed. During regeneration the plant's operator initiates an automatic sequence which takes the depleted unit through a series of backwash cycles, acid (4 wt% sulfuric acid) and caustic (4 wt% sodium hydroxide) additions, and rinse cycles. Wastes generated during the regeneration process, which have an initial pH of < 2, are stored in clearwells #1 and #2 prior to neutralization and discharge.

Hazards:

- Injury due to contact with skin or eyes of acid or caustic solutions during all phases of regeneration/neutralization procedure.
- Injury due to exposure (inhalation) to fumes from regenerant solutions (principally concentrated sulfuric acid).
- Violent reaction due to failure of piping system or by accidental mixing of acid and caustic regenerant solutions.

3.8.2 Bulk Storage Tanks

Two 3000 gallon storage tanks are located on the east side of the 1706KE Laboratory. One contains 93 wt% sulfuric acid and the other which contained 50 wt% sodium hydroxide, is now empty. The tanks are connected to the demineralize's chemical injection pumps by means of piping which enters the east wall of the building (in store rooms no. 2 and no. 3) and runs through a trench to the demineralize enclosure. Except during regeneration, these lines are isolated by means of valves located in store rooms no. 2 and no. 3.

Hazards:

- Injury due to contact with skin or eyes of concentrated acid or caustic materials.
- Injury due to exposure (inhalation) to fumes from concentrated acid or caustic solutions (principally concentrated sulfuric acid).
- Violent reaction due to leak of either tank or piping system.

3.8.4 Test Equipment

A variety of water treatment test units and other experimental devices are located on the 0-ft and -13-ft level of the 1706-KE Facility. These include an electrodialysis unit, ionpure unit, reverse osmosis unit, ion-exchange system, ultra-filters, high pressure and temperature loops (TF-9), and magnetic filtration devices. These units by their nature are not operated continuously, but rather as part of specific testing programs. The exact hazards associated with these units depend on the parameters of the test and the feed solution being tested. However, they can be generalized as follows:

3.8.4 Test Equipment (continued)

- Injury due to contact of skin or eyes with hazardous materials.
- Injury due to exposure (inhalation) to fumes from hazardous materials.
- Injury to due contact with fluids under high pressure and temperature.
- Injury to due to contact with electrical or mechanical devices (pumps, power supplies, mixers, etc.).
- Violent reaction and injury resulting from improper use or accident involving incompatible materials.

3.8.5 RCRA Decontamination Facility

All sampling components used for RCRA/CERCLA sampling activities at the hanford site are subjected to a rigorous decontamination procedure at the RCRA decon facility located in the 1706-KEL Facility. The decontamination process consists of several steps beginning with a soap/water wash followed by three demineralized water rinses, a 1 [M] nitric acid rinse, three ultra-pure water rinses, and a hexane rinse. The components are then heated in a oven at 100° C.

Hazards:

- Contact of skin or eyes with 1 [M] nitric acid.
- Exposure (inhalation) to hexane fumes.
- Fire (hexane is a highly flammable liquid).
- Injury from handling components with sharp edges
- Injury from repeated lifting of heavy components.

3.8.6 Waste Water Pilot Plant

The Waste Water Pilot Plant will include pilot-scale testing of various treatment technologies on the 242-A Evaporator process condensate such as pH adjustment, Reverse Osmosis, Ultraviolet Oxidation processes. Instruments for a real time laboratory analysis such as gas chromatography, ion chromatography, total organic carbon analyzer will also be in use to support these activities. The following are the hazards associated with the above systems:

3.8.6 Waste Water Pilot Plant (continued)

- pH adjustment system, will involve the handling of strong acids and bases such as Sulfuric Acid and Sodium Hydroxide. These chemicals are extremely corrosive. A potential exist for the unplanned release of these chemicals, and of the waste water that is being treated. Secondary containment pans will be used under the acid and base tanks, pH adjustment tanks, and metering pumps. The pH adjustment tank will vented the building ventilation system. If water were to enter the acid tank a violent reaction could occur. Acid transfer piping will be equipped with check valves to prevent this possibility.

- Reverse Osmosis system, involves high pressure. The system will shut automatically when pressures exceed 700 pounds per square inch. A potential exist for over pressurization, resulting in a ruptured vessel. The entire system has secondary containment.

- Ultraviolet Oxidation system, has a reactor pressure limit of 20 pounds per square inch. If the pressure in the reactor exceeds the pressure limit a graphite rupture disk will split. When the rupture disk splits a flow switch in the rupture disk line will cause an alarm to annunciate. The line on the rupture disk leads to an overflow tank. A potential exist for the unplanned release of the waste water that is being treated, and hydrogen peroxide. The entire system has secondary containment. Also there is potential for eye damage when looking directly into the ultraviolet light.

- Pilot Plant Waste Piping, transfers waste from the unloading area on the south side of the 1706KEL Building into the pilot plant, between the pieces of test equipment, to interim storage tanks located on the west side of the 1706KEL Building, and to the waste loading area located on north side of the 1706KEL Building. The potential exists for leaks at threaded joints located at valves, pumps, and tanks. The threaded connection will be equipped with secondary containment.

- Gas Chromatograph Analyzer, involves the use of hydrogen gas as a carrier gas. A potential exist for fire and explosion. The gas chromatograph also uses minute amounts of hazardous chemicals for calibration.

- Total Organic Carbon Analyzer, involves the use of Ultraviolet light for destruction of organic carbons. A potential exist for eye damage. The analyzer also uses corrosive chemicals.

3.8.7 Deactivated Systems

The majority of the piping and electrical systems which were part of the 1706-KE Buildings original mission have been deactivated. Routine activities in the laboratory do not require access or utilization of these systems and there are no plans to reactivate any of these systems.

Hazards:

- Injury caused by deactivated system (water system, electrical system, motor, pump, etc.) which was improperly deactivated or inadvertently reactivated.
- Exposure to residual hazardous material in a deactivated system (piping, storage tank, etc.).

3.8.8 Satellite Accumulation Areas

A satellite accumulation area is located in the 1706-KE RCRA Decon facility specifically for chemical waste generated by the RCRA decontamination process.

Additional accumulation areas will be established in the analytical lab to support the gas chromatograph and ion chromatograph, and the main lab to support the total organic carbon analyzer and organic extraction apparatus.

The hazards associated with a particular satellite accumulation area would depend entirely on the chemical waste contained there, however, they may be generalized as follows:

- Injury due to contact of skin or eyes with hazardous materials.
- Injury due to exposure (inhalation) to fumes from hazardous materials.
- Fire or explosion (assuming material is flammable or explosive).

3.8.9 Utilities

Electrical:

The main switch gear for the 1706-KE Laboratory is located in the 165-KE Building, 1706-KE -13-ft level control room, and on the 1706-KER 0-ft level, in addition breaker panels and disconnects are located throughout the facility.

Hazards:

- Injury due to electrical shock
- Fire due to electrical short

3.8.9 Utilities (continued)

Water:

Sanitary and service water are supplied to the 1706-KE Building from the 165-KE Building via the pipe tunnel at the -27-ft level pump room. Service water is supplied at 120 psi. Demineralized water is supplied by the demineralize plant throughout the building. In single pass mode the pressure is 120 psi, when operating in recirculating mode the pressure is 30 psi.

Hazards:

- Flooding caused by failure of service water line or incorrect configuration of valves (particularly in -27-ft pump room).
- Electrical hazard due to flooding or leakage of water systems.

3.8.10 Radon In The Work Place

The 1706-KE building is connected to the 105-KE, 165-KE, 105-KW, and 165-KW Buildings by means of a vast network of tunnels. The main pipe tunnel joins the 1706-KE Building at the -27-ft pump room. Since there is no active ventilation in this area, the air flow is generally from the -27-ft level to the -13-ft and main level by means of the stairways and a pipe shaft which connects all three levels. As a result, radon gas concentrates in the basement (-13-ft), sub-basement (-27-ft) as well as the main level work areas and office spaces. A study conducted by the Health Physics organization determined that radon levels were within occupational exposure limits. However, if you visit the facility, don't wear polyester clothing.

Hazards:

- Long term exposure by laboratory personnel, particularly those that frequent the -13-ft and -27-ft levels, to radon gas.

3.8.11 Asbestos In The Work Place

Much of the walls and piping throughout the 1706KE Building has asbestos insulation. The hazard associated with asbestos is that it is a carcinogen. If asbestos insulation is inadvertently exposed, contact the building manager so that the appropriate measures can be taken.

4.0 DESCRIPTION OF WHEN AND HOW BUILDING EMERGENCY PLAN WILL BE IMPLEMENTED

4.1 IMPLEMENTATION

The provisions of this Emergency Plan will be implemented when the building emergency director makes a determination that the severity of an incident is such that there is a potential to endanger human health or the environment. The plan will be implemented whenever there is an imminent threat of, or an actual incident as listed in section 3.0.

The building emergency director is responsible for assessing facility emergency incidents, to determine the level of action necessary to protect the personnel, facility, and the environment. If the incident requires assistance from patrol, fire, or ambulance units, notification to the Patrol Operations Center requesting the assistance is made by calling the Hanford Emergency Response Number 811. When additional resources or assistance from outside the facility other than from patrol, fire, or ambulance units is required, notification is given to the Emergency Duty Officer at the Patrol Operations Center business number (373-3800). For a relatively minor incident, the situation will be handled by facility personnel under the direction of the building emergency director and/or line management.

4.2 IDENTIFICATION OF HAZARDOUS MATERIALS

The building emergency director should be aware of the location, types and general amounts of all hazardous or dangerous materials or wastes in the facility. If there is an emergency incident and the materials or wastes involved are unknown, they will be identified by:

- Questioning witnesses or individuals familiar with the operations or area where the incident occurred or is occurring;
- Checking the label or placard on the container or tank, if it is visible from a safe distance;
- If the wastes cannot be identified by the above methods the Hazardous Materials Response Team will be called (811). The Hazardous Material Response Team will sample the waste in accordance with sampling and testing methods specified in WAC 173-303-110 and/or SW-846 (EPA 1986), and following proper chain-of-custody procedures, the samples will be packaged and transported to an analytical laboratory for analysis and identification.

4.3 EMERGENCY DOSE LIMITS

These limits only apply in an emergency. Every effort will be made to maintain doses as low as reasonably achievable.

Circumstances of Exposure	Maximum Single Dose (Whole Body)
Recover Hanford Criticality Radiation Dosimeters (see Section 9.3.3, of WHC-CM-4-1, Emergency Plan, for guidelines)	3 rem
Prevent property loss/reduce hazard	10 rem
In special circumstances, to reduce hazard or prevent substantial property loss	25 rem
Save a life or prevent severe effects on public health or safety	100 rem

5.0 EMERGENCY RESOURCES

5.1 BUILDING EMERGENCY ORGANIZATION

The personnel listed in Attachment A to this plan are the minimum recommended emergency staff of the building emergency response organization. The building response organization staffing requirements are identified in WHC-CM-4-1, "Emergency Plan," Section 8.0 (2.1.7).

In an emergency in which this plan is used, the acting building emergency director has the authority to commit the resources required to respond, including money, manpower, and/or equipment.

5.2 IDENTIFICATION AND DESCRIPTION OF EMERGENCY EQUIPMENT

A summary of the 1706KE Facility fixed and portable emergency equipment is provided below.

5.2.1 Fixed Emergency Equipment

Type	Location	Capabilities
Fire Control Systems		
Heat Detection System	Throughout bldg	Alerts bldg occupants and Fire Station
Alarms		
Heat detector for fire, see Section 6.3.1		
Pull Boxes (6)	see bldg. map	

5.2.1 Fixed Emergency Equipment (continued)

Emergency Exits

-13' level	Go through roll up door adjacent to control room and up the ladder on the south side of the building.
-27' pump room	Go up the ladder located near the building compressors to the escape hatch on the south side of the building.
-27' laboratory	Go up the ladder in the -27' cold lab to the escape hatch in the 1706-KER 0' level and exit through the nearest door.
-27' cells	Follow the corridor to the back stairway and then go corridor up to the 1706-KER 0' level and exit through the nearest door.

5.2.2 Portable Emergency Equipment

Type	Location	Capabilities
17 Fire Extinguishers	See Bldg Map	Use on any Class A, B & C fires

CO_2, dry chemical, D for metals

Fire Classification Examples
Class A wood, cloth, paper
Class B flammable liquids, gases, greases
Class C energized electrical equipment
Class D combustible metals, sodium, lithium

5.2.3 Protective Equipment

Type	Location
30 sets of SWP Clothing	-27' change room
30 Filtered Masks	-27' change room
1 Acid suit	0' men's locker room

5.2.4 Spill Control Equipment

Spill control equipment to be used for nonradioactive hazardous materials during an emergency and/or recovery phase has been identified.

50 absorbent pillows next to satellite accumulation area in KEL
10 boxes absorbent wipes throughout the building
200 pounds of absorbant NE corner of 0' level near loading dock (e.g., diatomaceous earth)

5.2.5 Emergency Monitoring Kit - N/A

5.3 EMERGENCY NOTIFICATIONS

5.3.1 Notification to Personnel Within The Facility

Facility personnel must be notified immediately if any conditions that affect facility occupants or operations are discovered.

If you discover an emergency:

1. LEAVE THE IMMEDIATE AREA if you may be harmed.

2. ACTIVATE THE NEAREST FIRE ALARM if you discover a fire.

3. GO TO THE STAGING AREA AND CALL 811 or 373-3800. Speak slowly and clearly. Provide:

    - Your name
    - The nature of the emergency
    - Exact location of the emergency.

    Have the person answering the call repeat the message back to you. The shift manager will assess the situation and determine if the building emergency director must be notified.

Depending on the severity of the incident, personnel in the facility, area, or Hanford Site will be notified about the emergency, using one or more of the emergency warning systems discussed below.

- Hanford Site Standard Emergency Signals. These siren alerts are summarized in page 27 of this plan and more fully described in Section 6.0 of WHC-CM-4-1, Emergency Plan.

- The building emergency director will inform all occupants.

- Alarm buzzer.

5.3.2 Notifications to Personnel and Organizations Outside of the Facility

Once the Emergency Action Coordinating Team (EACT) is activated, RL is responsible for all notifications to organizations or agencies other than DOE and WHC. Before the EACT is activated, the WHC Occurrence Notification Center (ONC) is responsible for these notifications.

The ONC is also responsible for reporting any release of hazardous or dangerous waste or materials (regardless of quantity) to the Washington Department of Ecology (WDOE), and reporting releases of hazardous or dangerous materials above reportable quantities to the National Response Center (NRC).

If there is a fire or explosion, the building emergency director or line management must immediately call 811 to notify the Patrol Operations Center.

5.3.2 Notification to Personnel and Organizations Outside of the Facility (continued)

If there is any unplanned release of hazardous or dangerous wastes or materials, the building emergency director must immediately notify the Hanford Fire Department Hazmat Team via 811 and WHC Environmental Protection. Environmental Protection notifies the ONC. The ONC must be notified of the release as soon as possible, not more than 1.5 hours after the release is discovered. The building emergency director or line management must document the emergency in accordance with MRP 5.14 and their specific reporting procedures.

Tell the Occurrence Notification Center:

- Name, telephone number, and contractor of person reporting
- Location of the release
- Date and time of the release
- Type and amount of material released
- Reportable quantity of the material
- Cause of the release
- Health and environmental impact of the release
- Clean up action in progress or required
- Whether a press release will be made
- Agencies requiring notifications.

5.4 EMERGENCY ALARMS AND WHEN/HOW THEY WILL BE ACTIVATED

5.4.1 Standard Emergency Alarms

SIGNAL	MEANING	ACTIONS
Steady tone or siren (3-5 minutes) or building P. A. system or at Manager's request	Area evacuation: radioactive or hazardous material release, bomb threat,	Get car keys, if time permits, and go to evacuation staging area
Wavering tone or siren (3-5 minutes)	Take cover: hazardous materials release, or security event where evacuation cannot be completed in a timely manner	Take cover in nearest building. Shut windows and doors. Shut off ventilation.
Howler (AH-OO-GAH)	Criticality, nuclear excursion	Run away from alarm sound and go directly to a designated staging area as identified in the Building Emergency Plan
Gong	Fire	Evacuate unless directed not to do so by Building Emergency Director
Continuous ringing bell and flashing red light	Potential airborne radiological contamination	Hold your breath and place one barrier between you and alarm
Crash Alarm (200, 300, and 400 Areas), steadily ringing telephone	Emergency communications	Pick up phone and listen. Relay message to the Building Emergency Director.
Emergency broadcast system (700 & 1100 Area facilities)	Notification of unusual event requiring protective actions	Tune radio to appropriate station and listen for instructions

5.4.2 Facility Specific Alarms and Emergency Signals

Not applicable.

* Call 3-2345 to hear a recording of the Standard Emergency Signals.

6.0 EMERGENCY RESPONSE PLANS

This section contains emergency response guides that pertain to the 1706KE Facility.

6.1 EVACUATION (Hanford Standard: STEADY SIREN)

6.1.1 Building Evacuation

If an evacuation is ordered or the evacuation siren sounds, employees should proceed to the primary or alternate staging area as identified below. The building emergency director will announce to which staging area to evacuate.

Area	Location	Lane
PRIMARY STAGING AREA	Parking Lot	Lane 3
ALTERNATE STAGING AREA	River Gate	Lane 3

6.2 TAKE COVER (Hanford Standard Emergency Signal: WAILING SIREN)

6.2.1 Take Cover Response

When notified of a "Take Cover" by the building emergency director, personnel should take cover in the nearest building (1706KE).

6.3 BOMB THREAT RESPONSE GUIDES

A bomb search kit containing some or all of the following items is maintained by the Hanford Patrol.

- Flashlights.
- Bump hats, and gloves.
- Set of maps.
- Marking pens (for marking up search plans on maps).
- Mirrors and extension handles.
- Crescent wrenches (for mirror adjustments).
- Thread or string (to mark paths to objects for investigation).
- Green tape (for repairs, holding string, etc.).
- Masking tape (for taping off areas searched).

6.3.1 Actions if You Get a Telephoned Bomb Threat

If you get a telephoned bomb threat, respond as follows.

NOTE: Attempt to engage the caller in conversation on the phone as long as possible, and get as much information as you can. Use the bomb threat checklist for questions to ask.

1. Record as much information about the call (threat, caller mannerisms and voice features, background noise, etc.) on the Bomb Threat Checklist (Form BD-9100-201R).
2. Initiate facility evacuation.
3. Notify the building emergency director.
4. Notify the Patrol Operations Center (811) once the call is over.

6.3.2 Actions if You Get a Written Bomb Threat

If you get a written bomb threat, respond as follows.

1. Handle the letter as little as possible to preserve fingerprints and avoid smudging.
2. Immediately notify the Patrol Operations Center (811) and the building emergency director. Tell no one else.
3. Record all details of the receipt (i.e., where found, how delivered, when found, etc.)
4. Release the letter only to WHC Security personnel or to a person authorized by WHC Security.

6.3.3 Actions if You Discover a Bomb or Suspicious Object

If you discover a bomb or suspicious object, respond as follows.

1. Clear the immediate area of personnel. Do not transmit on a radio near the object.
2. Immediately notify the Patrol Operations Center (811) and the building emergency director.
3. Ensure that no one enters the area until by standing guard in a sheltered location at the maximum possible distance.

6.4 OPERATIONAL EMERGENCY RESPONSE PLAN

The following sections contain response plans for each type of emergency or hazard identified in Section 3.0 of this plan.

6.4.1 Utility Disconnect Plan For 1706KE Facilities

Use these steps to place the utilities in a safe and secure condition when an emergency has been declared, or when directed by the building emergency director.

6.4.1.1 Heating, Ventilation, and Air Conditioning (HVAC).

The shut down of the HVAC systems in 1706-KE and 1706-KER can be done by placing the breaker on the MCC panel in the OFF position. These MCC are located in the control room at the -13 foot level. The shut down of the HVAC systems in 1706-KEL can be done by placing the appropriate disconnect on the north wall in the OFF position.

6.4.1.2 Electrical.

The main power disconnect for the 1706-KE Facilities are located in the 165-KE Switch Gear Room located across from the 1706-KE Building.

6.4.2 Industrial

Assess the situation and notify the building emergency director, if appropriate, evacuate the building. Shut off supply water and/or electrical. Dial 811.

6.4.3 Loss of Electricity

If there is a sudden disconnect of electricity to the 1706-KE Facilities personnel must evacuate. As result of loss of electricity the exhaust ventilation systems will shut down, leaving contaminated hoods unventilated. This result leads to potential of airborne radioactivity. Notify the Health Physics Technicians to perform a personnel survey. A building survey by the Health Physics Technicians is required before reentry.

6.4.4 Loss of Water - N/A

If there is a sudden loss of water, emergency eye washes and sdhowers will not operate. As result of this on needing this emergency equipment must be shutdown. Laboratories and the Waste Water Pilot Plant must evacuated until water is restored.

6.4.5 Loss of Ventilation

Same as Loss of Electricity. See section 6.3.3.

6.4.6 Loss of Steam - N/A

6.4.7 Loss of Air - N/A

6.4.8 Fire

Fire fighting in the 1706KE facility is complicated by the presence of radioactive material which may cause contamination. The avoidance of breaching containment of the building is extremely important.

The building emergency director (or alternate) is responsible for ensuring that the following actions are performed; however, all personnel are responsible for the initial steps and notifying others if a fire is detected or an explosion occurs at this facility.

Person discovering a fire or near an explosion

- Activate the nearest fire alarm box
- Notify the building emergency director
- Call 811 and request Fire Department.
- *During a fire if hazardous materials are involved, notify the Fire Department of this fact to ensure appropriate response from the Hazmat Team.*

Building Emergency Director

- Confer with Health Physics and Nuclear Facility Safety for criticality/contamination controls and area postings
- Assign someone to meet Fire Department personnel and direct them to the alarm or fire
- Go to the scene, assess the situation, and request necessary help

Facility occupants

- *Response to the fire alarm shall be to evacuate the building, in process facilities evacuate the fire area and standby for further instructions*
- *Facility personnel should only use fire extinguishers in the incipient or beginning stages of a fire. Otherwise, they should exit the building or area and close the door behind them to minimize fire spread.*
- Attempt to move injured personnel only if they are in a life threatening situation. Otherwise, stabilize them until emergency medical personnel arrive.

6.4.8 Fire (continued)

Fire Department Hazardous Material Response Team

- Goes to the scene and initiates actions to control the incident in coordination with the building emergency director

- Establishes an incident command post in a safe location and requests assistance as necessary

- Remove injured personnel to a safe area, provide immediate first aid and prepare for transport to a full service medical facility for medical treatment

- Request Hanford Patrol to establish roadblocks to prevent unauthorized personnel from entering as necessary

Once the fire is controlled and extinguished or the cause of the explosion has been eliminated AND there is no longer an imminent threat to human health then the balance of this procedure is implemented.

Building Emergency Director

- Announce an "all clear" signal

- *Ensure properly trained personnel isolate hazardous materials* and stabilize them until they can be removed in a nonemergency mode and properly treated or disposed

- Clean and repair emergency equipment and return to a condition fit for reuse

- Replace all expendable supplies.

6.4.9 Major Test Disruption - N/A

6.4.10 Pressure Hazards Emergency Response

The E&ED (Engineering and Environmental Demonstration Laboratory) has several high temperature/high pressure test loops. Pressure hazards exist only if any of the test loops are in operation. See the responsible building personnel to shutdown and depressurize this loop.

6.5 NATURAL HAZARDS RESPONSE PLAN

6.5.1 Volcanic Eruption/Ash Fall

Volcanic eruptions and ash fallout from the Cascade Mountain Range are a possibility. Notification to the facility in the event that ash fallout is imminent would be through the telephone. The following actions should be taken upon notification that an ash plume is headed for the Hanford Reservation.

Building Emergency Director

- Contact the emergency control center and obtain meteorology data necessary to estimate time of arrival for the ash plume

- Decide whether to evacuate or initiate Take Cover emergency response.

  Follow the "Evacuation" response in Section 6.1 or the "Take Cover" response in Section 6.2

- Protect supply air inlets and reduce ventilation flows as appropriate.

- Evaluate necessity of shutting down some or all of the processes. If required, notify appropriate personnel to begin shutdowns.

- Maintain communication with the emergency duty officer or the area emergency control center to discuss building condition and changing fallout conditions.

6.5.2 Seismic Event Response

The WHC emergency response organizations' primary role in a seismic event is coordinating the initial response to injuries, fires and fire hazards, and acting to contain or control radioactive and/or toxic material releases.

6.5.2.1 Seismic Event Response During the Event.

Each building emergency organization must be ready to respond following a seismic event affecting the Hanford Site and WHC Facilities, personnel and property.

The following guidelines identify the responses (by appropriately trained individuals) necessary to respond to a seismic event at this facility.

- Promptly assess post-earthquake emergency needs

- Act as necessary to protect building personnel and those onsite and offsite

- Report needs to 811 or the area emergency control center

6.5.2.1 Seismic Event Response During The Event (continued)

- Search for injured or trapped employees
- Conduct accountability
- Render first aid
- Search for fires and other hazards
- Fight fires
- Turn off water, gas, and electricity
- Perform facility inspection
- Consider shutdown of operating systems
- Arrange for rescue of personnel
- Form a recovery plan
- Perform cleanup.

6.5.2.2 Response During a Seismic Event.

During an earthquake, building personnel should:

- Remain calm
- Stay away from windows, steam lines, and gloveboxes (indoors)
- Respond to all emergency signals
- Avoid objects which could fall or release hazardous material.

6.5.2.3 Response After a Seismic Event.

After an earthquake:

- Follow the building emergency director's instructions
- Check others for injuries and administer first aid
- Call 811 for emergency assistance; notify plant management
- Do not use matches or lighters
- Do not touch downed power lines or objects touched by downed wires
- Do not use the telephone or PAX (except for emergency communications)
- Establish damage assessment teams for the local area and areas beyond the facility

6.5.2.3 Response After A Seismic Event (continued)

- Determine if release of inventories of hazardous material (radioactive or nonradioactive) is occurring or likely to occur
- Determine current local meteorology
- Warn adjacent facilities of event using: crash alarm, radios, telephone, runners, and/or Hanford Patrol rover vehicles
- Initiate road closures (Highway 240, and/or onsite roadways) to reduce potential exposures
- Provide resources and personnel assistance to other affected personnel and facilities.

6.5.3 High Winds/Tornado

If appropriate, take cover at the -13' or -27' levels.

6.5.4 Flood

Remain at or above the 0 foot level. The closest flood would be 8' below 105KE.

6.5.5 Range Fire - N/A

6.6 HAZARDOUS MATERIALS/MIXED WASTE RESPONSE PLAN

Anyone may discover a nonradioactive hazardous material or mixed waste spill. Anyone trained in using spill equipment may use emergency equipment to clean up a spill (with proper respiratory and personnel protective equipment). However, the immediate response for all spills of hazardous materials should be to notify 811 and request the Hanford Fire Hazmat Team. The Hanford Fire Department will determine if a response is required.

6.6.1 Spill Response Plan

<u>If you discover a hazardous material spill</u>

- Assess the severity of the situation.
- Notify the Hanford Fire Department Hazmat Team via 811
- If the release can be controlled safely and promptly, do so; if not notify the building emergency director.

Building Emergency Director

- Assess the situation; determine the type and quantity of material(s) released and the hazards involved. *Spill equipment should only be used if the quantity is small and the spill is a known substance.*
- Activate the appropriate emergency alarms (if necessary), and use the public address system (PAX) to notify personnel in the immediate area.

Facility Personnel

- Respond to the emergency alarm and standby for further instructions over the PAX public address system.

Building Emergency Director

- Initiate appropriate actions to contain/control the waste or material if response is within the capabilities of the emergency response organization. *However, the Hanford Fire Department Hazmat Team will be notified via 811 of all hazardous material spills.*
- Direct facility personnel to take those actions that can be safely performed to control or contain the release before assistance arrives.
- Direct an individual to meet emergency responders from outside the facility and direct them to the event scene.

Hanford Fire

- Proceed immediately to the scene and initiate actions to control the incident, in coordination with the building emergency director.
- Establish an incident command post in a safe location and request additional assistance as necessary. *The incident command post will be integrated with other responding agencies.*
- Rescue personnel, provide immediate first aid, and prepare injured personnel for transport to a full service medical facility.
- *Request Hanford Patrol to* establish roadblocks or other traffic control measures to prevent unauthorized personnel from entering the area.
- Stabilize and isolate residual hazardous materials by covering or other appropriate means, until they can be removed in a non-emergency mode and properly treated or disposed.

Building Emergency Director

- Announce an "all clear" signal once the release is contained and controlled AND there is no longer an imminent threat to human health.
- Cleanup emergency equipment used in responding to the incident; Prepare all emergency equipment for reuse. Replace all expendable supplies.

6.6.2 Fire and Explosion Associated with Hazardous Materials

Explosions may cause or result from a fire, or may be totally disassociated. For this plan, fire and explosion are treated simultaneously. Special chemical hazards are addressed in the Fire Department "Pre-Fire Plans," located in the 1706KE office exit.

If You Discover a Fire Involving Hazardous Materials

- Avoid inhaling smoke, fumes, or vapors, even if no hazardous waste is involved.
- Activate the nearest fire alarm and call 811.
- Notify the building emergency director or operations shift office. Provide as much information as possible without personal risk.
- Move and keep people away from fire scene.

Building Emergency Director

- Identify the character, exact source, amount and extent of any released materials. Request support from Process Engineering for this effort.
- If the emergency involves a hazardous waste storage area, contact the 100 Areas Hazardous Waste Coordinator (373-1006), to identify the materials involved.
- Contact the Patrol Operations Center at 811 or 3-3800 and provide as much information as possible. Request additional assistance as required.
- Evacuate part or all of the facility. Ensure that the staging area remains safe.
- Consider requesting Patrol to evacuate personnel along adjacent streets and roadways.
- Ensure that the Fire Department Hazardous Material Response Team has been notified.

Building Emergency Director (continued)

- Relay pertinent information, including telephone number and proposed location of the technical support center.

- Establish a command post, in a safe location.

6.6.3 Toxic Fume Release

Anyone may discover a nonradioactive hazardous material toxic fume release. Rapid communication is vital in warning personnel and notifying appropriate response personnel. *To ensure proper personnel protective equipment is used, patching or stopping the release should not be attempted unless the toxic substance has been positively identified.*

If You Discover a Toxic Fume Release

- TREAT ALL FUME RELEASES AS TOXIC, UNLESS ABSOLUTELY KNOWN TO BE HARMLESS.

- Avoid inhaling smoke, fumes, or vapors, even if no hazardous waste is involved.

- Do not assume that gasses or vapors are harmless just because they lack an odor.

- Contact the building emergency director or operations shift office immediately and provide as much information as possible without personal risk.

- Keep people away from the area of the release.

Building Emergency Director

- Identify the character, exact source, amount, and extent of any released materials.

- Refer to the material safety data sheets for information necessary to determine what type of respiratory and personnel protective equipment should be used to isolate the spill area and/or stop the leak.

- If the emergency involves a hazardous waste storage area, contact the plant hazardous waste coordinator to identify the materials involved.

- Notify the Patrol Operations Center at 811 and request that the Fire Department Hazardous Material Response Team be dispatched if assistance is required. Provide as much information as possible.

- Assign someone to meet the HAZMAT Team and direct them to the spill.

Building Emergency Director (continued)

- Assess hazards to human health and the environment (considering direct, indirect, immediate, and long-term effects) that may result from the spill.
- Contact PNL Meteorology Station on 3-2716 to determine the wind speed, direction, and stability classification.
- Take all reasonable measures necessary to ensure that fires, explosions, and releases do not occur, recur, or spread to other dangerous waste at the facility.
- Where applicable, stop processes and operations, collect and contain released waste, and remove or isolate containers.
- Evaluate evacuating part or all of the facility; consider the location of the spill and ensure the safety of the evacuation staging area.
- Consider shutting down the intake air supply system, and/or retain personnel inside the building.

6.6.4 Reactive Corrosive Chemical Hazard

The same as Section 6.5.1, Spill Response Plan. Contain and clean up the spill, if possible.

6.6.5 Thermal Reaction

Add copious amounts of water and contain the release or use the appropriate fire extinguisher (D) in the case of a metal fire. Clean up and/or evacuate as appropriate.

6.6.6 Flammable Liquids/Materials

If the spill is small, contain and clean up. If the spill is large, evacuate immediately. Extinguish open flames immediately. If near electrical equipment, evacuate immediately.

6.6.7 Asbestos Release

Asbestos containing materials are normally well encapsulated to ensure that asbestos fibers do not become airborne. An asbestos hazard emergency condition arises when a large portion of the encapsulation is damaged and the asbestos containing material is dispersed in the area. Much of the piping throughout the 1706KE Building has asbestos insulation. If an asbestos release occurs:

- Evacuate all personnel from the affected area
- Isolate and post the area
- Contact Industrial Safety and Fire Protection to determine remedial action
- Contact the building emergency director and provide information
- Identify a recovery/cleanup plan (at the direction of Industrial Safety and Fire Protection and a trained asbestos worker supervisor).

6.7 RADIOACTIVE MATERIALS RESPONSE PLAN

6.7.1 Radioactive Gaseous Effluent Discharge - 4 Stacks

All potentially contaminated gaseous effluent discharges are periodically sampled to determine radioactivity. The hood ventilation stacks for 1706KE are operable. If radioactivity is found in the sample, shutdown and isolate the system.

6.7.2 Radioactive Liquid Effluent Discharge

Control the spill and clean up.

6.7.3 Significant Contamination Spread

Typically this is indicated by a Continuous Air Monitor (CAM) alarm. Respond to a CAM alarm by:

- Holding your breath until you move out of the affected area; go to where there is at least one barrier between you and the affected area.
- Contact Health Physics and stand by for survey and contamination status. If the room is found to be contaminated, Health Physics will place the room on airborne contamination status.
- Notify immediate manager and the building emergency director.

6.8 CRITICALITY RESPONSE PLAN - N/A

6.9 EXPLOSIVE MATERIALS/MUNITIONS HAZARDS RESPONSE PLAN - N/A

6.10 PREVENTION OF RECURRENCE OR SPREAD OF FIRES, EXPLOSIONS, OR RELEASES

To ensure that fires, explosions, or releases do not occur, reoccur, or spread, plant/facility operations have been reviewed to identify potential hazards and Plant Operating Procedures (POP) have been developed to minimize the occurrence of unplanned incidents.

Safety systems such as automatic fire sprinklers, automatic process shutdown controls, spill containment structures, and contaminated waste stream diversion systems have been installed to ensure that if an emergency occurs, the affected area will be kept to a minimum.

Once the emergency response to an incident is complete, the building emergency director is responsible for analyzing the events that lead to the incident and for conducting a critique to determine the circumstances of the occurrence, including cause(s), impacts, and lessons learned from the incident.

The requirements of DOE Order 5484.1 must be followed to ensure that all appropriate parties are aware of, and participate in decisions on the best course(s) of action to take to prevent or minimize the possibility of future occurrences. *Additionally, emergency responders performing isolation and stabilization of hazardous materials shall be trained in accordance with OSHA 29CRF 1910.120, paragraph q, and NFPA 472.*

Specific steps that may be taken for a particular incident could include:

- Isolating the area of the initial incident to minimize the spread of a release and/or the potential for a fire or explosion (by shutting off power, closing off ventilation systems, etc.)
- Inspecting containment structures for cracks or leaks
- Removing released material and waste remaining inside of containment structures as soon as possible
- Containing and isolating residual waste material using dikes and absorbents
- Covering or otherwise stabilizing areas where residual released materials remain, to prevent wind or precipitation runoff from causing the material to spread
- Installing new facilities, systems, or equipment to enable better management of hazardous or dangerous wastes or materials.

7.0 TERMINATION OF EMERGENCY

Normally, it is the building emergency director's responsibility to declare the termination of an emergency; however, once the WHC emergency response organization is activated, only the area emergency director or the WHC Emergency Director shall declare that an emergency has ended.

If the RL EACT is activated, only the RL Director shall officially terminate the emergency.

NOTE: In all cases, however, the building emergency director must be consulted before reentry is initiated.

8.0 ACCIDENT RECOVERY

The recovery phase of the accident is handled according to a recovery plan developed for the specific event, not emergency criteria.

Facility managers establish emergency response organizations that encompass all required aspects of engineering, operations, maintenance, and functional support, with direction provided by the Hazardous Waste Unit and the Industrial Hygiene and Safety Department.

Recovery includes making proper notifications to proper agencies (such as the U.S. Department of Energy, U.S. Environmental Protection Agency, or Washington State Department of Ecology).

Recovery also includes recapture (where possible), storage, and disposal of any released material, and storage and disposal of any contaminated soil or surface water (or any other material) that results from a spill, toxic fume generating event, fire or explosion.

No waste that may be incompatible with the released material may be treated, stored, or disposed of until cleanup is completed.

All emergency equipment shall be cleaned and prepared for reuse immediately following an emergency.

Consult WHC-CM-4-43, <u>Emergency Management Procedures</u>, Section G-3.06, "Recovery Following Emergency Events at Westinghouse Hanford Company Facilities," for further information on recovery following emergencies.

9.0 POST EVENT ANALYSIS AND REPORTING REQUIREMENTS

Damage assessments should be made at the conclusion of the emergency phase and the results of these assessments must be communicated to the emergency control centers. The building emergency director should designate a recovery manager who will determine necessary steps to return the facility to an operational status. The following items should be considered.

- Building Structures (walls, ceilings, systems, etc.)
- Utilities - Electricity, Water, and Telephone
- Hazardous Materials/Processes
  - Radioactive Systems or Equipment
  - Chemical System
  - Toxic
  - Reactive
  - Corrosive
  - Explosive
  - Pressure Systems
  - Pressure Vessels
  - Compressed gas lines - air
  - Cryogenic
- Waste Systems
  - Process sewer line
  - Process water line
  - Sanitary water line
- Heating Ventilation and Air Conditioning
- Safety Eyewash/safety shower
- Sirens & Alarms
  - Fire Alarm
  - Hanford Standard Emergency Alarms

WASTE WATER PILOT PLANT
SUPPLEMENT TO THE EMERGENCY RESPONSE PLANS

INTRODUCTION

The waste water pilot plant testing activities will include pilot-scale testing of different types of treatment equipment on a variety of waste water streams. The waste water pilot plant will consist of waste storage tanks and different types of test equipment such as ultraviolet oxidation equipment and ion exchange columns. The test equipment will be provided with secondary containment, where required. The test equipment will be connected together by piping.

The 1706KE Building Emergency Plan includes a description of the following:

- 1706KE Building layout and exits
- Staging areas
- Potential emergency conditions
- Implementation of the building emergency plan
- Internal and external notifications
- Emergency alarms
- Safety equipment
- Prevention of recurrence or spread of fires, explosions, or releases
- Termination of emergency conditions
- Accident recovery
- Post event analysis and reporting requirements.

Also included are emergency response plans for specific emergencies at the 1706KE Building. The emergency response plans include the following:

- Response to building evacuation and take cover alarms
- Response to bomb threats
- Operational emergency response plan
- Natural hazards response plan
- Hazardous materials/mixed waste response plan
- Criticality, explosive materials/munitions hazards.

The 1706KE Building Emergency Plan will be followed during testing at the waste water pilot plant. In addition, the following emergency response steps specific to the waste water pilot plant will be included in the emergency response plans as described in the following sections.

ATTACHMENT C

WASTE WATER PILOT PLANT CONTINGENCY PLAN

C.1 INTRODUCTION

Due to the nature of the work at the waste water pilot plant, additional requirements are identified in this attachment that augment the 1706KE Building Emergency Plan.

C.1.1 Facilities Covered by This Plan

Waste water pilot plant

C.1.2 Location of the Facility

Located in the 1706KEL Laboratory as shown on Figure 1.5.1 of the 1706KE Building Emergency Plan

C.1.3 Description of Facilities and Operations

The waste water pilot plant will perform pilot-scale testing on various effluent streams, some of which will be designated as dangerous or mixed waste.

C.2 PURPOSE OF THE PLAN

The purpose of this plan is to provide supplemental emergency response information specific to waste water pilot plant emergency conditions.

C.3 DESCRIPTION OF POTENTIAL EMERGENCIES

Potential emergencies include leaks or spills and fire and explosion.

C.4 DESCRIPTION OF WHEN THE PLAN WILL BE IMPLEMENTED

This plan will be implemented when a leak or spill of hazardous material, fire, or explosion would occur. After modification of the waste water-pilot plant testing area is complete, this plan will be reviewed and revised as necessary.

C.5 EMERGENCY RESPONSE PLAN

The emergency response plan consists of the 1706KE Building Emergency Plan and the supplemental information contained in this attachment.

ATTACHMENT B

RCRA REGULATED UNIT CONTINGENCY PLAN

B.1 INTRODUCTION

This attachment is supplemental to the 1706KE Building Emergency Plan and provides specific information and response plans for the 100N Area RCRA Regulated Unit. Due to the nature of this regulated unit, special plans identified here are required for response to emergencies at this location.

B.1.1 Facilities (Satellite Accumulation Areas) Covered by this Plan

1706KEL Satellite Accumulation Area (3 pages)

B.1.2 Location of the Facilities

Located in the 1706KE Laboratory 1 near the entrance on the wall adjacent to the change room.

B.1.3 Description of Facilities and Operations

This Accumulation Area accumulates inorganic and mixed wastes.

B.2 PURPOSE OF THE PLAN

The purpose of the plan is to respond to upset conditions or emergencies at each individual satellite accumulation area.

B.3 DESCRIPTION OF POTENTIAL EMERGENCIES

Potential emergencies include fire, explosion, leaks, or spill to the environment.

B.4 DESCRIPTION OF WHEN THE PLAN WILL BE IMPLEMENTED

The plan would be implemented when any abnormality would occur.

B.5 EMERGENCY RESPONSE PLAN - <u>ONE CONTINGENCY PLAN</u>

ATTACHMENT A

BUILDING EMERGENCY RESPONSE ORGANIZATION LISTING

A.1 K Area Emergency Director

	Name	Location	Phone
Primary:	Fuel & K/D Operations Manager	1720K	3-1608

A.2 Building Emergency Directors

	Name	Location	Phone
Primary:	Environmental Demo. Lab. Tech.	1706KE	3-1589
Alternate:	Environmental Demo. Lab. Mgr.	1706KE	3-4972

A.3 Staging Area Managers

	Name	Location	Phone
Primary:	Outer Facilities Maint. Secretary	1720K	3-3778
Alternate:	Nuclear Mat. Control Specialist	1720K	3-1681

A.4 Evacuation Bus Drivers

	Name	Location	Phone
Primary:	Driver	165KE	3-3811
Alternate:	Open	1717K	3-3666

ADDITIONAL STEPS FOR ALL EMERGENCY RESPONSES

For the waste water pilot plant activities, the following emergency response steps be added to all emergency response plans.

- If emergency conditions allow, stop the flow of waste through the pilot plant by turning off all waste pumps and/or waste control valves from the storage tanks. This is accomplished by turning off the feed pump on each individual equipment unit (e.g., UV/OX, reverse osmosis) The feed pump shut off switches are located on the each equipment control panel.

- The electrical switches are located near the each waste pump or the power can be shut off at the 1706KE electrical panel, located on the north wall of the pilot plant room (See Figure 1.5.1).

- If the conditions do not allow for individual unit shutdown, the entire waste water pilot plant will be electrically shutdown by throwing the main utility disconnect in the 165-KE switch room as described in the utility disconnect plan (Section 6.3.1 of the 1706KE Building Emergency Plan. This disconnect method will also shut down the building ventilation system and should only be used if the shut down methods can not be implemented.

- Follow the steps indicated in the 1706KE Building Emergency Plan, Section 6.0, 'Emergency Response Plans' for the specific emergency condition.

ADDITIONAL STEPS FOR SPILL RESPONSE PLAN

For leaks or spills at the waste water pilot plant, the following emergency response steps will be added.

- At the detection of a leak or spill terminate all testing activities.

- If emergency conditions allow, stop the flow of waste through the pilot plant by turning off all waste pumps and/or waste control valves from the storage tanks. This is accomplished by turning off the feed pump on each individual equipment unit (e.g., UV/OX, reverse osmosis) The feed pump shut off switches are located on the each equipment control panel.

- The electrical switches are located near the each waste pump or the waste water pilot plant power can be shut off at the 1706KE electrical panel, located on the north wall of the pilot plant room (See Figure 1.5.1).

ADDITIONAL STEPS FOR SPILL RESPONSE PLAN (continued)

- If the conditions do not allow for individual unit shutdown, the entire waste water pilot plant will be electrically shutdown by throwing the main utility disconnect in the 165-KE switch room as described in the utility disconnect plan (Section 6.3.1 of the 1706KE Building Emergency Plan. This disconnect method will also shut down the building ventilation system and should only be used if the shut down methods can not be implemented.

- If the leak is NOT contained in the secondary containment, follow the steps indicated in the 1706KE Building Emergency Plan, Section 6.5.1, 'Spill Response Plan' for the specific emergency condition.

- Notifications to Ecology and the EPA Administrator, Region 10 must be made through the Occurance Notification Center if any waste leaks to the environment.

- If the leak is contained by secondary containment equipment:

  - Terminate the testing.

  - Before resuming operations after any leak or spill, failed test equipment will be repaired or replaced as necessary.

  - Waste will be removed from the secondary containment and secondary containment will be decontaminated as required. Decontamination may require the use of decontamination liquids. The decontamination liquids are supplied by health physics technicians or personnel performing the decontamination activities. Decontamination liquids are not routinely stored at the 1706KE Building.

  - Decontamination solutions consisting of liquids removed from secondary containment or liquids generated during decontamination operations will be containerized, properly designated as nondangerous, dangerous, or mixed waste, and disposed of in accordance with existing Hanford Facility procedures.

  - Dispose of all rags, wipes and other clean up materials in approved containers and treated as hazardous waste.

  - All emergency equipment listed in Section 5.2 (e.g., absorbent pillows or wipes) will be replaced or decontaminated, as required.

  - An assessment of the accident should be made to prevent a recurrence of the event.

- Notifications to Ecology and the EPA Administrator, Region 10 must be made through the Occurance Notification Center if the leak to secondary containment exceeds 10 gallons.

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